



**LAN ASSOCIATES**

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**CONTRACT DOCUMENTS  
AND  
TECHNICAL SPECIFICATIONS  
FOR  
2019 BOND REFERENDUM  
CAPITAL IMPROVEMENTS  
AT  
CHATSWORTH AVENUE SCHOOL  
NYSED #66-07-01-03-0-005-020  
BID # 19/20-MUFSD-010**

Mamaroneck Union Free School District  
1000 West Boston Post Road  
Mamaroneck, NY 10543

Telephone No. 914-220-3040

Contact: Ms. Sylvia Wallach  
Assistant Superintendent for Business

**LAN Job #4.1092.72.03**

NYSED Submission: January 10, 2020

Issue to Bid: November 23, 2020





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Contact: Ms. Sylvia Wallach  
Assistant Superintendent for Business

I, Michael J. McGovern, RA certify that to the best of my knowledge, information, and belief, the drawings and specifications are in accordance with applicable requirements of the Building Code of New York State, the State Energy Conservation Construction Code, and Building Standards of the New York State Education Department.

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Michael J. McGovern, RA  
NY RA #022257

**LAN Job # 4.1092.72.03**  
NYSED Submission: January 10, 2020  
Issue to Bid: November 23, 2020



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B.

LIST OF DRAWINGS  
(24" x 36" Not Bound in Specifications)

**2019 BOND REFERENDUM**

Chatsworth Avenue School  
34 Chatsworth Ave  
Larchmont, NY 10538

DWG.  
NO.

TITLE

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## NOTICE TO BIDDERS

MAMARONECK UNION FREE SCHOOL DISTRICT

### **2019 Bond Referendum**

#### **Capital Improvements at Chatsworth Avenue School**

(NYSED #66-07-01-03-0-005-020)

Bid # 19/20-MUFSD-010

PUBLIC NOTICE is hereby given that sealed bids shall be received by the Board of Education, Mamaroneck Union Free School District, 1000 West Boston Post Road, Mamaroneck, New York 10543 for the following contracts:

Contract #3a - General Construction  
(includes site/civil & abatement)  
Contract #3b - Mechanical  
Contract #3c - Plumbing  
Contract #3d – Electrical

A detailed description of the work is included in the bid specifications.

Sealed bid proposals shall be received by **2:00p.m. prevailing time on Thursday, January 14, 2021**, by mail or in person at the Boston Post Road main entrance, at the Mamaroneck Union Free School District Office, 1000 West Boston Post Road, NY 10543. All bids must be received by 2:00p.m. prevailing time. **Staff will be available to accept hand delivered bids between the hours of 8:00 a.m. and 2:00 p.m. on Thursday, January 14, 2021. Due to the current COVID-19 pandemic, the District buildings are restricted and non-essential individuals will not be permitted inside. Bids will be publicly opened and read aloud at 3:30p.m. via livestream on Google Meet at the following URL Address: [meet.google.com/xtu-eoaj-bjd](https://meet.google.com/xtu-eoaj-bjd) using computer audio or call in audio via phone: +1 442-600-5525 PIN #: 147 172 790#.**

**All envelopes containing bids shall bear on the face of the sealed envelope the words “January 14, 2021, Bid for Capital Improvements at Chatsworth Avenue School, AND the Contract number being bid on.” No Bids shall be accepted after 2:00p.m. prevailing time on January 14, 2021. Please be reminded that USPS, UPS and FedEx delivery schedules may be limited. Please allow enough time for your proposal to arrive on or before the due date and time.**

The plans and specifications may be examined/obtained at REV Ventures, Inc., 330 Route 17A, Suite 3, Goshen, NY 10924, or at their website [www.usinglesspaper.com](http://www.usinglesspaper.com) or by phone (845) 651-3845 between 9:00 a.m. and 5:00 p.m. Monday through Friday beginning on **Monday, December 7, 2020**. A bid deposit of \$100 payable to Mamaroneck Union Free School District by check or money order is required to obtain printed documents. The deposit is refundable if the bid documents are returned in good condition within 30 days of contract award. Complete digital sets of Bidding Documents, drawings and specifications may also be viewed online with a free user account or downloaded for a non-refundable fee of Forty-Nine (\$49.00) dollars at [www.usinglesspaper.com](http://www.usinglesspaper.com) under public projects.

Please note that all bidders must obtain bid packages from REV Ventures, Inc. or at their website [www.usinglesspaper.com](http://www.usinglesspaper.com) in order to submit a bid for this project. REV Ventures, Inc. or their website [www.usinglesspaper.com](http://www.usinglesspaper.com) is the **ONLY** authorized distributor of the bid package and all bidders must be on their bidders list.

All bid addenda will be transmitted to registered plan holders via email and will be available at [www.usinglesspaper.com](http://www.usinglesspaper.com). Plan holders who have paid a deposit for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use, and coordinate directly with Rev. Ventures Inc. for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.





Any questions regarding the bid process shall be directed to Lauren Leone, Purchasing Agent, in writing by fax to 914-220-3091 or by email to [LLeone@mamkschools.org](mailto:LLeone@mamkschools.org). All technical questions regarding the bid should be directed to LAN (Attention Ms. Danielle Farrell) in writing by fax to 845-615-0351 or by email to [danielle.farrell@lanassociates.com](mailto:danielle.farrell@lanassociates.com) with a copy to the District's Purchasing Agent.

A pre-bid conference, including site visit, will be held on **Tuesday, December 15, 2020 at the Chatsworth Elementary School, 34 Chatsworth Avenue, Larchmont, NY 10538 at 4:00 p.m.** All bidders are strongly encouraged to attend this pre-bid conference. Please be advised that masks are mandatory and temperature scan will be done upon entry to the building. Any bidder who cannot attend the pre-bid conference should schedule a site visit on an appointment only basis by contacting Mr. Stephen Brugge, Director of Facilities, at 914-220-3081. No questions will be answered at the site visit. **Knowledge of the site is crucial to obtain a proper understanding of the Work.** All bidders must be fully familiar with the site.

Each bid must be accompanied by a certified check payable to Mamaroneck Union Free School District or by a Bid Bond in an amount equal to ten percent (10%) of the bid as set forth in the Bid Specifications.

Each Bidder shall prepare their bid proposal, along with a bid security, in accordance with the terms and subject to the conditions set forth in the Bid Specifications. Attention of bidders is particularly called to the minimum wage rates to be paid under the contracts. Wages to workers, laborers and mechanics employed to work on this project shall be paid in accordance with Section 220 of the Labor Law and in accordance with the Prevailing Rate Schedules found in the Project Manual. Submission of certified payroll is required as a condition of this contract. Additional information can be obtained at <http://www.labor.state.ny.us/workerprotection/publicwork/PWContents.shtm>.

The Contractor must comply with all applicable laws, rules and regulations governing the Project, including the "Equal Opportunity for Employment" requirements as promulgated by the Federal and State governments.

Each bid must be accompanied by bid security in the form of a certified check made payable to the Mamaroneck Union Free School District or by a Bid Bond in an amount equal to ten percent (10%) of the bid. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.

BOARD OF EDUCATION  
MAMARONECK UNION FREE  
SCHOOL DISTRICT  
1000 West Boston Post Road  
Mamaroneck, New York 10543  
By: Lauren Leone  
Purchasing Agent



## SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 Opening of Bids: Bids will be opened at the time and place set forth in the Advertisement for Bids. Every bid received by or before that time, or authorized postponement thereof, will be publicly opened and read aloud. Bidders, their representative, or other persons properly interested may be present via livestream following the format listed in the Advertisement for Bid.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof or may waive any informalities in or reject any or all bids. Any bid may be withdrawn prior to the advertised time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within forty-five (45) days after the actual opening thereof.

Conditional bids will not be accepted.

2.0 Bidding Documents: The bidding documents include the Advertisement for Bids, Instruction to Bidders, Form of Proposal, General Conditions, Supplementary General Conditions, Division 1 - General Requirements, Specifications, Drawings, and all Addenda issued prior to the opening of bids.

3.0 Preparation of Proposal: Proposals must be submitted on prescribed forms. All blank spaces must be filled in, by hand, in ink or in typewritten format. Where indicated by the forms, figures must be inserted.

Note - All contractors, this project is to be bid, the contracts drawn and payments made in such a manner that Sales and Compensating Use Taxes of the State of New York and of cities and counties will not apply to purchases and sales of materials and supplies.

Note - Contractor shall note that whenever brand names or specific product systems are indicated, it shall be clearly understood that such identification is for the purpose of illustrating the type of product and the degree of quality desired. Such identification in no way precludes the contractor from using products of other manufacturers which can be shown in advance to be of like kind and of equal quality.

All envelopes containing bids shall bear on the face of the sealed envelope the words **“January 14, 2021, Bid for Capital Improvements at Chatsworth Avenue School, AND the Contract number being bid on.”** Each proposal must be submitted in a sealed envelope and shall have clearly designated on the outside the name and address of the bidder, the name of the project, and the contract for which proposal is submitted.

4.0 Non-Collusive Bidding Certificate: Each prime bidder submitting a bid for any portion of the work contemplated by the bidding documents shall execute a non-collusive certificate as required by applicable New York State law, in the form herein provided, to the effect that he has not colluded with any other person, firm, or corporation in regard to any bid submitted. Such certificate shall be attached to the bid. Failure of any bidder to abide by this provision shall be cause for rejection of his bid.

5.0 Qualification of Bidders: The Owner may make such investigation as it deems necessary to determine the ability of the bidder to perform the work and the bidder shall furnish to the Owner all information and data for this purpose as the Owner may request. The Owner reserves the right, in its sole discretion, to reject any bid if the evidence submitted by, or through investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated herein within the time frame specified. The bidder must complete and submit with its bid the Statement of Bidder's Qualifications and the Qualifications of Bidders forms. Failure to submit the documentation requested may result in disqualification of the bid.

The bidder must complete and submit with its bid the Statement of Bidder's Qualifications and the Qualifications of Bidders forms.



6.0 Bid Security: Each proposal shall be accompanied by a bid bond or certified check. The choice of security to be at the option of the Contractor.

Bid security shall be in amounts as follows:

1. Bid Bond shall be in the amount of 10% of the base bid and shall be on AIA Form A310. It shall be duly executed by the bidder as principal, having as surety thereon a surety company approved by the Owner.
2. Certified checks shall be in the amount of 10% of the base bid made payable to the Mamaroneck Union Free School District.

The remaining security will be returned to the two (2) lowest bidders within 48 hours after the Owner and the successful bidder have executed the contract, or, if no contract has been so executed, within forty-five (45) days after the formal bid opening provided that the bidder has not been notified of the award of the contract.

7.0 Liquidated Damages for Failure to Enter Into Contract: A successful bidder, upon his failure or refusal to execute and deliver the Contract and bonds required within ten (10) days after he has received notice of the acceptance of his proposal, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his proposal.

8.0 Subcontractors and Material Suppliers: The successful bidder for each Contract shall submit to the Architect/Engineer within ten (10) calendar days after receipt of notification of award of contract, on the form supplied, a list of subcontractors, material suppliers, and manufacturers proposed for the various portions of the work.

9.0 Conditions of Work: Each bidder must inform himself fully of the conditions relating to the construction and labor under which the work is now being or will be performed. Failure to do so will not relieve a successful bidder of his obligations to furnish all material and labor necessary to carry out the provisions of the contract documents and to complete the contemplated work for the consideration set forth in his bid. The Contractor in the carrying out of his work must employ such methods or means as will not cause any interruption or interference with the work of any other contractor, or the operations of the Owner.

10.0 Obligations of Bidders: At the time of the opening of bids, each bidder will be presumed to have inspected the site, to have familiarized himself with local conditions, and to have read and to be thoroughly familiar with the bidding documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect to his bid or resultant contract.

11.0 Assessments and Taxes:

1. Exemptions from Sales Tax: The Sales and Compensating Use Taxes of the State of New York and the cities and counties do not apply to purchases and sales of materials and supplies pursuant to the provisions of this contract. These taxes are not to be included in the bids. This exception does not, however, apply to tools, machinery, equipment or other property leased by or to the Contractor or a Subcontractor or to materials and supplies of a kind which will not be incorporated into the completed project.
2. Other Assessments and Taxes: Each bidder shall include in his base bid proposal all other costs and liabilities other than that excluded in the above paragraph for the amounts assessed or taxes upon the wages and salaries paid to employees of the



Contractor and his Subcontractors, under the Contractor, or any other taxes assessed by the Federal, State, or Local Government.

12.0 Addenda and Interpretations: No interpretations of the meaning of the drawings, specifications or other contract documents will be made to any bidder orally. Any and all such interpretations and any supplementary instructions will be provided in the form of written addenda to the specifications or addenda drawings. Addenda will be sent to all prospective bidders at the respective address, fax or email address furnished by the bidder. Failure of any bidder to receive any such addendum or interpretation shall not relieve any bidder from any obligations under this bid as submitted. All addenda so issued shall become part of the contract documents.

13.0 Security for Faithful Performance: The successful bidder shall deliver to the Owner, simultaneously with the executed contract, an executed Performance and Labor and Material Payment Bond each on AIA Form 312 in quadruplicate, in the amount of one hundred percent (100%) of the contract amount, and which meets the requirements of Article 11 of the General Conditions. The premium for said bonds shall be included in the Contractor's Base Bid. The surety company or companies shall be acceptable to the Owner and Architect/Engineer and authorized to transact business in New York State.

The current power of attorney for the person who signs for any surety company shall be attached to such bond, indicating the surety or sureties on the bond.

14.0 Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows:

1. If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.
2. If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.

The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.

The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.

15.0 Owner-Contractor Agreement: Form of contract to be used will be the Owner-Contractor Agreement included in these specifications and prepared by this office.

16.0 Maintenance Bond: Prior to authorization of the final payment by the Owner, and prior to the receipt by the Contractor of its final payment, the Contractor shall furnish to the Owner a maintenance bond in the amount of 100% of the total compensation earned by the Contractor in connection with the work. The bond shall be in a form acceptable to the Owner and with a surety company acceptable to the Owner. It shall remain in effect for two years after the date of authorization of the final payment by the Owner.

17.0 Payment/Performance Bond: The successful bidder will be required to procure a performance and a payment bond as set forth at Article 11 of the General Conditions. All bonds shall be





issued by a Surety licensed to issue bonds in the State of New York. All surety companies are subject to approval by the Owner.

18.0 Compliance with Applicable Laws and Regulations:

- A. Bidder must comply with applicable federal, state, and local laws as well as all ordinances, rules, and regulations affecting work.
- B. The provisions of General Municipal Law, Section 103A, as it relates to refusal to testify or sign a waiver of immunity against prosecution and the submittal of bids and transactions with the State of New York, or a political subdivision thereof, governs work under this contract.
- C. Wage rates as determined by the New York State Industrial Commission pursuant to the labor laws of the State of New York apply to all work under this contract.

19.0 Pre-Bid Conference:

- A. A pre-bid conference, including site visit, will be held on Thursday, December 10, 2020 at the Chatsworth Elementary School, 34 Chatsworth Avenue, Larchmont, NY 10538 at 4:00 p.m. All bidders are strongly encouraged to attend this pre-bid conference. Please be advised that masks are mandatory and temperature scan will be done upon entry to the building. Any bidder who cannot attend the pre-bid conference should schedule a site visit on an appointment only basis by contacting Mr. Stephen Brugge, Director of Facilities, at 914-220-3081. No questions will be answered at the site visit. Knowledge of the site is crucial to obtain a proper understanding of the Work. All bidders must be fully familiar with the site.
- B. All requests for clarification and/or questions concerning the bid specifications will be addressed via written addendum to all prospective bidders. Addenda clarifying pertinent questions or concerns raised during the bidding period and following site-visits requiring modification of the bid documents, will be issued for the record and become part of the bid documents.
- C. Notice as to the time and place of pre-bid conference is stated in the Invitation to Bidders.

20.0 Modification or Withdrawal of Proposal:

- A. Bid may not be modified after it has been deposited with Owner.
- B. Bid may not be withdrawn after time set for receipt of bids except as set forth in section 103, subsection eleven (11) of the General Municipal Law.
- C. Withdrawn bid may not be resubmitted.
- D. Bid withdrawn after opening of bids may result in forfeiture of bid security.

21.0 Time of Completion: Bidder shall agree to start work upon receipt of Notice to Proceed, and complete within the number of calendar days specified in the Special Provisions of the Specification. Project must be completed no later than the date specified in the Special Provisions of the Specification.

22.0 Condition of Work Operations:

- A. Work under this Contract shall be executed and pursued without interruption of or interference with the Owner's operations.



- B. Work operations, access to buildings, and extent of movement of personnel within buildings shall be coordinated with the Construction Manager and limited by School District Authorities.
- C. Contractor shall notify the Construction Manager at least twenty-four (24) hours in advance to advise of intended work operations to be scheduled and receive approval prior to starting work.

23.0 Sexual Harassment Prevention Form:

- A. A Sexual Harassment Prevention Form has been included under Specification Section 004400.
- B. By submission of this form, the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees.

24.0 Insurance Coverage Affidavit:

- A. An Insurance Coverage Affidavit has been included in Specification Section 007316 and shall accompany bids.

END OF SECTION 002113



## 003126 – EXISTING HAZARDOUS MATERIAL INFORMATION

### 1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. An existing asbestos report for Project, prepared by Quality Environmental Solutions & Technologies, Inc, dated January 10, 2020 is available for viewing as appended to this Document.
- C. An existing PCB report for Project, prepared by Quality Environmental Solutions & Technologies, Inc, dated January 10, 2020 is available for viewing as appended to this Document.
- D. An existing lead report for Project, prepared by Quality Environmental Solutions & Technologies, Inc, dated January 10, 2020 is available for viewing as appended to this Document.
- E. Related Requirements:
  - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
  - 2. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.
  - 3. Section 024119 "Selective Structure Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.
  - 4. Section 028200 "Asbestos Abatement" for notification requirements if materials suspected of containing asbestos materials are encountered.

END OF DOCUMENT 003126



## 003132 – GEOTECHNICAL DATA

### 1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. A geotechnical investigation report for portion of the Project, prepared by SESI Consulting Engineers, dated November 22, 2019 is available for viewing as appended to this Document.
- C. Soil-boring data for a portion of the Project, performed by SESI Consulting Engineers, dated November 22, 2019 is available for viewing as appended to this Document provided as an attachment to the geophysical survey and soil boring investigation report.
- D. Related Requirements:
  - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
  - 2. Document 003126 "Existing Hazardous Material Information" for hazardous materials reports that are made available to bidders.

END OF DOCUMENT 003132







Geotechnical  
Foundations  
Land Planning  
Geo-Structural  
Environmental  
Water Resources

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*Principals:*

Steven P. Byszewski, PE, PP  
Anthony Castillo, PE  
Fuad Dahan, PhD, PE, LSRP  
Roger Hendrickson  
John M. Nederfield, PE  
Justin M. Protasiewicz, PE  
Kenneth Quazza, PE  
Michael St. Pierre, PE

November 22, 2019

via email: [paul.ercolano@lanassociates.com](mailto:paul.ercolano@lanassociates.com)

Paul Ercolano, P.E.  
LAN Associates  
445 Godwin Avenue, Ste 9  
Midland Park, NJ 07432

**RE: Geotechnical Investigation Report  
Chatsworth Avenue School  
34 Chatsworth Avenue  
Larchmont, New York  
SESI Project No. 10996**

Dear Mr. Ercolano:

In accordance with our Professional Services Agreement dated October 9, 2019, we have completed our geotechnical investigation for the above referenced project. This report contains a description of our investigation, an evaluation of the subsurface soil and groundwater characteristics, and presents recommendations for general site preparation procedures and foundation design criteria for the proposed construction.

If you have any questions, please call.

Sincerely,

**SESI CONSULTING ENGINEERS D.P.C.**

Nhan "Yung" Dang, P.E.  
Assistant Project Engineer

**Encl: Geotechnical Investigation Report Dated November 22, 2019**

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## **GEOTECHNICAL INVESTIGATION REPORT**

**FOR**

**Chatsworth Avenue School  
34 Chatsworth Avenue  
Larchmont, New York**

**PREPARED FOR:**

LAN ASSOCIATES  
445 Godwin Avenue, Ste 9  
Midland Park, NJ 07432

**PREPARED BY:**

SESI CONSULTING ENGINEERS D.P.C.  
12A Maple Avenue  
Pine Brook, NJ 07058

Job No.: 10996

DATE:

November 22, 2019

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Nhan "Yung" Dang, P.E.

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John M. Nederfield, P.E.  
NY Lic. No. 92958

## INTRODUCTION AND PROPOSED CONSTRUCTION

We have completed our geotechnical investigation for the proposed addition to the existing Chatsworth Avenue School. The school is bounded to the north by Chatsworth Avenue, to the east by Addison Street, to the west by Forest Park Avenue, and to the south by residential buildings and Larchmont Avenue beyond. The site is currently occupied by a two two-story school buildings with basements, connected by a corridor, with associated playground, track, basketball courts, and retaining walls along Chatsworth Avenue and Addison Street. A chain link fence enclosed a majority of the site.

Based on our review of the drawing *Chatsworth Avenue School Site Plan*, prepared by LAN Associates, dated April 2, 2018, *Code Analysis Plans*, prepared by LAN Associates, dated October 11, 2019, and your emails dated November 4, 2019 and November 12, 2019, we understand that the proposed construction consists of a four (4) story addition which will have an elevator located at the approximate center of the addition. The addition will have a footprint of approximately 604 square feet and will be located at the northern side of a narrow corridor, which connects the two main buildings. The addition area is currently occupied by a paved walkway, an elevated landscape area, and concrete retaining walls.

Based on the topographic information provided on the Site Plan, the paved walkway is at approximately elevation 44 and the elevated landscape area adjacent to the sidewalk is at approximately elevation 48. We have been informed by you that the proposed first floor grade will be at approximately elevation 43.63 and the lowest footing for the elevator will be at approximately elevation 36.13.

At the time of this writing, we had not been provided with the building loads for the proposed addition; however, we have assumed moderate column and wall loads in our analysis. Based on the provided proposed building grades, it is anticipated that cuts of up to approximately 6± feet will be required to reach the slab subgrade elevation and cuts of up to approximately 12± feet will be required to reach the elevator footing subgrade elevation. Rock excavation will be required in order to attain the proposed grades, therefore, the removal of the rock adjacent to the existing foundations will require further evaluation by a qualified Geotechnical Engineer. Once the final site and grading plans, and building loads are available, we should be provided an opportunity to review them to confirm that our recommendations remain valid.

## FIELD AND LABORATORY INVESTIGATIONS

Our engineering study consisted of a site reconnaissance, a review of existing soils and geologic data, and a field investigation consisting of the drilling of two (2) soil borings. The borings were drilled on November 2, 2019 to depths of approximately 3.4± feet and 4.7± feet below the ground surface using a subcontracted ATV-mounted drill rig and a tripod-mounted drill rig. Ground surface elevations were interpolated from the *Chatsworth Avenue School Site Plan*.

The locations of the borings are shown on the ***Boring Location Plan***, which is included as ***Figure 1***. Individual soil boring logs, which describe the materials encountered, are presented as ***Figures 2 and 3***. A key to soil terminology is included as ***Figure 4***.

Soil samples suitable for identification purposes were extracted from the borings at closely spaced intervals in accordance with the procedures of the Standard Penetration Test (ASTM D1586). For this test, a standard split-spoon sampler (2 inches outside diameter; one and three-eighths inches inside diameter) is driven into the soil by a 140-pound weight falling 30 inches. After discounting the initial six inches of penetration due to possible disturbance of the material resulting from the drilling operation, the number of blows required to drive the sampler a distance of 12 inches is recorded and designated as the standard penetration resistance or "N value". The "N value" provides an indication of the relative compactness of the soil in-situ.

All fieldwork was performed under the direct technical observation of a geotechnical engineer from SESI Consulting Engineers D.P.C. Our representative located the borings in the field, maintained continuous logs of the borings as work proceeded and performed the soil sampling operations in order to develop the required subsurface information.

All soil samples were taken to our soil mechanics laboratory for additional classification and appropriate geotechnical testing. Laboratory testing consisted of one (1) mechanical grain size analysis and one (1) water content determination. The water content is presented on the individual boring log. The result of the mechanical grain size analysis is presented on the individual boring log and in graphical form as **Figure 5**.

## **GENERALIZED SUBSURFACE CONDITIONS**

According to United States Geological Survey (USGS), the site surficial geology consists of till overlying bedrock. The bedrock is mapped as mica schist and mica gneiss, medium to coarsely crystalline.

The following subsurface conditions were encountered in order of increasing depth:

Surficial Materials: At the surface, an approximate 2-inch thick layer of asphalt pavement was encountered in boring B-1 and a 7-inch thick layer of topsoil was encountered in boring B-2.

Natural Soils: Natural soils were encountered beneath the surface materials to the refusal depths of the borings. The natural soils are residual soils that are derived from the weathering of the underlying bedrock. The residual soil consists primarily of coarse to fine gravel, and coarse to fine sand, trace silt, with weathered rock fragments. Based on the N-values obtained during the soil sampling operation, the natural residual soils are in a medium dense to very dense condition.

Bedrock: Auger and split-spoon refusal was encountered in borings B-1 and B-2 at depths of 3.4± feet and 4.7± feet below the ground surface, which correspond to approximate elevations 40.6± feet and 43.3± feet, respectively. A rock outcrop was observed immediately to the east of boring B-2. Based on our observation, the auger and split-spoon refusal likely indicates the top of bedrock.

Groundwater: Groundwater was not encountered in the borings during the short period of time that the holes were left open. However, small amounts of groundwater seepage should be anticipated at the soil-rock interface during periods of recent precipitation. In

addition, groundwater might be encountered during the construction of the proposed elevator pit which extends below the bottom of the borings.

## **EVALUATION AND RECOMMENDATIONS**

The recommended site preparation and building support considerations discussed in this report are based primarily on geotechnical engineering considerations. Our geotechnical design considerations may require modifications to address environmental and/or legal considerations.

### **General**

From a soils and foundation support standpoint, this site can be considered excellent with respect to providing satisfactory support of the planned addition. The bedrock will provide suitable support for conventional shallow foundations with high allowable bearing capacities. The floor slab should be constructed as a slab-on-grade supported by the natural dense residual soils, or controlled compacted fill, if required.

It is anticipated that rock excavation will be required to attain the proposed building footings and slab and elevator pit grades. It is anticipated that the excavation of the rock may be accomplished through the use of mechanical rock excavation, (i.e. excavator with hydraulic hoe-rams). It should be noted the rock generally will become more sound and the rock excavation may become more difficult with depth.

### **Specific Building Area Procedures**

Site preparation should begin by stripping the pavement, topsoil, and removing all existing surface improvements and utilities from within and at least five feet beyond the limits of proposed construction, where possible. Any excavations created by the removal of the existing structures and utilities should be backfilled with controlled compacted fill if they extend below the proposed grades in structural areas. The controlled compacted fill should be placed in accordance with the recommendations of this report under the observation of a geotechnical engineer.

The removal of the residual soil and rock should not exceed the depth of the existing footing grade without evaluation by the geotechnical engineer. Depending on the depth of the existing building foundations and whether or not they are bearing directly on sound rock, the existing building may need to be underpinned prior to excavating for the addition's foundation. After underpinning the existing building, if required, the excavation can continue to the proposed grades.

It should be anticipated that the removal of rock will be required to achieve the proposed grades. Rock excavation should be performed using mechanical means or controlled blasting if necessary. The contractor should pay particular attention to the removal of the existing onsite soil and rock materials along the proposed excavation side wall alignments to avoid undermining adjacent structures.

The slab subgrade should be proofrolled with a vibratory roller under the observation of a qualified geotechnical engineer where the subgrade is on the natural residual soil. The proofrolling should consist of making a minimum of 4 complete coverages of the area. Any soft areas disclosed during the proofrolling should be excavated to stable material

and backfilled in compacted lifts to achieve 95 percent of Modified Proctor density (ASTM D 1557).

The inorganic cut soils may be used as structural fill provided that any deleterious materials are removed. The fill should be placed in maximum 12-inch thick lifts, with each layer compacted to the required density using a vibratory roller. Building area fills should be compacted to a minimum of 92 percent with an average of greater than 95 percent of the Modified Proctor density (ASTM D 1557).

Areas, which will not have any foundations or other structural loads, may be compacted to a minimum of 90 percent of the maximum Modified Proctor density (ASTM D 1557).

Offsite borrow material, if required, should have a maximum particle size of 6 inches and the maximum amount of fines (percentage passing a No. 200 mesh sieve) should be 15% to help facilitate construction during wet weather. The "fines" should be non-plastic.

Backfill in confined areas such as utility trenches and foundations within load bearing areas should be placed in maximum 6-inch thick layers and compacted to a minimum of 92 percent and average of greater than 95 percent density as described above.

The subgrade should be graded to drain and tight-rolled at the end of the day, particularly if wet weather is anticipated.

If stormwater seepage is encountered during construction, gravel filled sumps with pumps should be installed below the subgrade elevation to allow for dewatering of the excavation.

#### **Utility Lines**

The Site soils will provide suitable support for utility lines. Cobbles greater than 4 inches in diameter should be removed from the utility line subgrade or a minimum 4-inch thick sand layer placed beneath the utility lines. If the bottom of the excavation for any utility lines falls within soft soils, the excavation should be extended an additional 12-inches and replaced with 3/4-inch clean crushed stone or clean sand and gravel. In any areas where the utility lines are excavated into rock, a minimum of 6 inches of ¾-inch clean crushed stone or sand layer should be placed beneath the pipe.

Backfill material placed around utility lines to 6 inches above the utility lines should have a maximum particle size of 1.5 inches. Backfill of utility trenches that fall within load-bearing areas should be placed in maximum 6-inch thick lifts and compacted to a minimum of 92 percent and average of 95 percent of Modified Proctor density (ASTM D 1557). Trench backfill in non-load bearing areas should be compacted to 90 percent of Modified Proctor density (ASTM D 1557).

#### **Slopes and Excavations**

All temporary excavations greater than 4 feet in depth should have the sides sloped back or be appropriately sheeted and braced in accordance with OSHA and all applicable codes, including but not limited to, temporary shoring, trench boxes and benching evaluated by a qualified Geotechnical Engineer.

The contractor should pay particular attention to the removal of the existing onsite soil and rock materials along the proposed excavation side wall alignments to avoid undermining adjacent structures.

Underpinning of the existing foundation, adjacent to the proposed addition, may be required for the excavation to reach the lower level grade if the existing footings are not founded on sound rock. Any new footings constructed should match or be lower than the elevation of the existing footings. An additional investigation to determine the depth of the existing footings and the footing subgrade material would be required in order to determine the need to design underpinning for the project.

### **Underpinning**

The underpinning, if required, will be constructed following the alternate pit method based upon the underpinning design. The underpinning design should be done by a registered Professional Engineer licensed in the State of New York. Each underpinning pit should be excavated and formed according to the design drawings, to a predetermined width, depth, and thickness. Each underpinning pit will then be poured with concrete and allowed to reach required strength prior to excavating the adjacent underpinning pit. The day following the underpinning pit pour, steel wedges and dry packing are placed to transfer footing loads to underpinning piers. Caution should be taken when excavating below the existing footing to prevent loosening or eroding of materials supporting the footings and slabs. As the underpinning construction is performed, the existing building should be carefully monitored for movement.

### **Control of Groundwater**

Groundwater was not observed in the borings at the time of our investigation; however, the borings did not extend to the proposed excavation depths. Groundwater should be anticipated at the soil and rock interface during periods of recent precipitation. Depending on the depth of the groundwater, hydrostatic pressures may need to be considered in the foundation design. To prevent dampness, all below grade walls should be damp-proofed and a moisture/vapor barrier be placed on the underside of the slab-on-grade. A drainage board (MiraDrain) or stone backfill should be placed along the foundation wall to allow any groundwater to flow down to the footing drains. If groundwater is encountered during foundation construction, it may be necessary to install a permanent dewatering system which could consist of drywells with permanent sump pumps.

If stormwater runoff or groundwater seepage is encountered during construction, gravel filled sumps with pumps should be installed below the subgrade elevation to allow for dewatering of the excavation.

Foundation drains are required for any retaining walls below grade and should be tied to the storm sewer system or to a sump with pump.

## **FOUNDATION DESIGN CRITERIA**

After the site preparation procedures described above are completed, spread/strip footings and a slab-on-grade floor system may be constructed on the natural residual soils, bedrock, or controlled compacted fill, if required. Footings founded on the natural soils may be designed for a maximum bearing pressure of 2 tsf (4,000 psf) and footing bearing on bedrock may be designed for a maximum bearing pressure of 6 tsf (12,000 psf).

Regardless of the loads, the minimum plan dimension of isolated footings should be 36 inches and the minimum width of continuous footings should be 24 inches. Exterior footings and those footings potentially exposed to frost action should be founded a minimum of 3.5 feet below adjacent exterior grade or as required by the local building department. Footings founded on sound bedrock do not need to meet the minimum depth of 3.5 feet below adjacent exterior grade.

Footing excavations should be left open for as short a time as practical to avoid excessive disturbance to the exposed subgrade. Should the bottom of a footing excavation become softened or disturbed during construction, the soft or loose material should be excavated and replaced with clean  $\frac{3}{4}$ -inch crushed stone. If water is encountered, it should be controlled locally with gravel filled sumps.

All below grade walls should be provided with positive drainage behind the wall to preclude hydrostatic pressures from developing. The external drainage system should be tied to the internal drainage system for permanent drainage.

The floor slab should be designed using a subgrade modulus of 175 pci, assuming that a 6-inch thick layer of granular material with a maximum particle size of 1.5 inches and a maximum percent passing the No. 200 mesh sieve of 12 percent is placed beneath the floor slab.

After satisfactory completion of the outlined building area preparation procedures, footings founded on the bedrock should have negligible settlements.

### **Permanent Walls**

Permanent below-grade walls should be designed to resist lateral loadings from static earth pressure, water pressure (where present), and vertical surcharges. We recommend the following design parameters:

- For braced walls (no rotation) a triangular earth pressure distribution with an equivalent fluid pressure of 60 pounds per square foot per foot of depth for unsaturated soil.
- For cantilevered walls a triangular earth pressure distribution with an equivalent fluid pressure of 39 pounds per square foot per foot of depth for unsaturated soil.
- Lateral pressures due to surface surcharges should have a uniform distribution based on a pressure equal to 0.5 times the vertical pressure for the entire depth of the wall.
- We recommend using a minimum surcharge load of 250 pounds per square foot to account for fire truck loading scenarios.

All retaining walls should be provided with positive drainage behind the wall to preclude hydrostatic pressures from developing.



**Seismic Design**

The site soils have been classified as Site Class B for seismic design purposes in accordance with the 2015 International Building Code.

Based on a structural occupancy/risk category of II and information provided by the Seismic Design Maps, developed by Structural Engineers Association of California (SEAO) and California's Office of Statewide Health Planning and Development (OSHPD), the following seismic design criteria should be used for this project:

Mapped Spectral Response Acceleration for Short Periods	$S_S = 0.287g$
Mapped Spectral Response Acceleration for 1-Second Period	$S_1 = 0.06g$
Site Coefficient	$F_a = 0.9$
Site Coefficient	$F_v = 0.8$
Spectral Response for short periods	$S_{MS} = 0.258g$
Spectral Response for 1 second period	$S_{M1} = 0.048g$
Design Spectral Response Acceleration for Short Periods	$S_{DS} = 0.172g$
Design Spectral Response Accelerations for 1-Second Period	$S_{D1} = 0.032g$

**TESTING REQUIREMENTS**

During the placement of all fill, visual observations and in place density tests should be performed to determine the adequacy of the fill. Density testing should be done in accordance with the following minimum frequency requirements or as determined by the geotechnical engineer:

Building Areas: Minimum of 2 tests per 12-inch lift.

Minimum density requirements are outlined in the previous sections of this report.

**ADDITIONAL INVESTIGATIONS**

At the start of work, we recommend excavating test pits adjacent to the existing building to determine the extent and depth of the existing footings with respect to the proposed foundation bearing depths.

**INSPECTION**

The recommendations presented in the previous sections of this report are based on the assumption that the site preparation procedures will be done under engineering inspection by SESI. We should inspect the proofrolling operations, the placement of the compacted fill, if required, the bottom of the footing excavations prior to the placement of concrete and/or stone. Visual observations and in-place density testing should be done throughout fill construction to determine that the work is done in accordance with our recommendations.

**LIMITATIONS**

The subsurface investigation performed identifies the subsurface conditions only at the locations of the explorations and at the depths where the samples were taken. SESI Consulting Engineers D.P.C. reviews the published geologic data and the field and

laboratory data and uses their professional judgment and experience to render an opinion on the subsurface conditions throughout the site. Because the actual subsurface conditions may differ, we recommend that SESI be retained to provide construction inspection in order to minimize the risks associated with unanticipated conditions.

This report should not be used:

1. When the nature of the proposed building is changed;
2. When the size or configuration of the proposed building are altered;
3. When the location or orientation of the proposed building are modified;
4. When there is a change in ownership; or
5. For application to an adjacent or any other site.

SESI shall not accept any responsibility for problems, which may occur if SESI is not consulted when there are changes to the factors considered in this report's development. The soil logs should not be separated from the Engineering Report in order to minimize the possibility of soil log misinterpretation.

#### **DISCLAIMER**

This Report was prepared by SESI for the sole and exclusive use of LAN Associates. Nothing under the Professional Services Agreement between SESI and its client, LAN Associates, shall be construed to give any rights or benefits to anyone other than Client and SESI, and all duties and responsibilities undertaken pursuant to the Agreement will be for the sole and exclusive benefit of Client and SESI and not for the benefit of any other party. This Report has been prepared and issued subject to the express condition that same is not to be disseminated to anyone other than Client, without the advance written consent of SESI (which SESI, in its sole discretion, is free to grant or withhold). Use of the Report by any other person is unauthorized and such use is at the sole risk of the user.

**TABLE I**  
**SUMMARY OF SOIL DESIGN PARAMETERS**

PARAMETER	VALUE
1. Allowable Bearing Capacity –Natural Soils (net) Bedrock (net)	4,000 psf 12,000 psf
2. Total Unit Weight	125 pcf
3. Angle of Internal Friction - Backfill against Structures	34 degrees
4. Earth Pressure Coefficient (See Note 1) Active Earth Pressure (Ka) Earth Pressure @ Rest (Ko) Passive Earth Pressure (Kp)	0.28 0.44 3.54
5. Coefficient of Sliding (concrete over soil)	0.45
6. Subgrade Modulus for Floor Slab Design Granular Fill	175 pci
7. Slopes (above groundwater) Maximum Cut Slope in Soil Maximum Fill Slope in Soil	2.0 H:1V 2.0 H:1V
8. Seismic Design Criteria- Site Class	B
9. Minimum Footing Depth (exterior footings) (except footings on sound rock)	3.5 feet

Notes:

- 1.) A drainage medium should be installed along all retaining walls to avoid hydrostatic pressures from developing.
- 2.) Compaction equipment used within 5± feet of permanent walls should not weigh more than 5,000 pounds.
- 3.) Recommended slopes in #7 above do not consider surcharge loading above. Any slopes greater than 15 feet high or have surcharge loading should be further evaluated by a geotechnical engineer.

N:\ACAD\10996\CADD\10996 FIG-1 BORING LOCATION PLAN 2019-11-20.DWG 11/20/19 04:18:40PM. aas, LAYOUT: FIG-1

NOTE:  
THIS PLAN IS FOR LOCATING BORINGS ONLY.  
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

NYS Education Law  
Unauthorized alterations or additions to this plan are a violation of  
section 7209 (2) of the New York State Education Law. Copies of this  
map not having the seal of the engineer shall not be valid.

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without written permission of SESI CONSULTING ENGINEERS D.P.C.

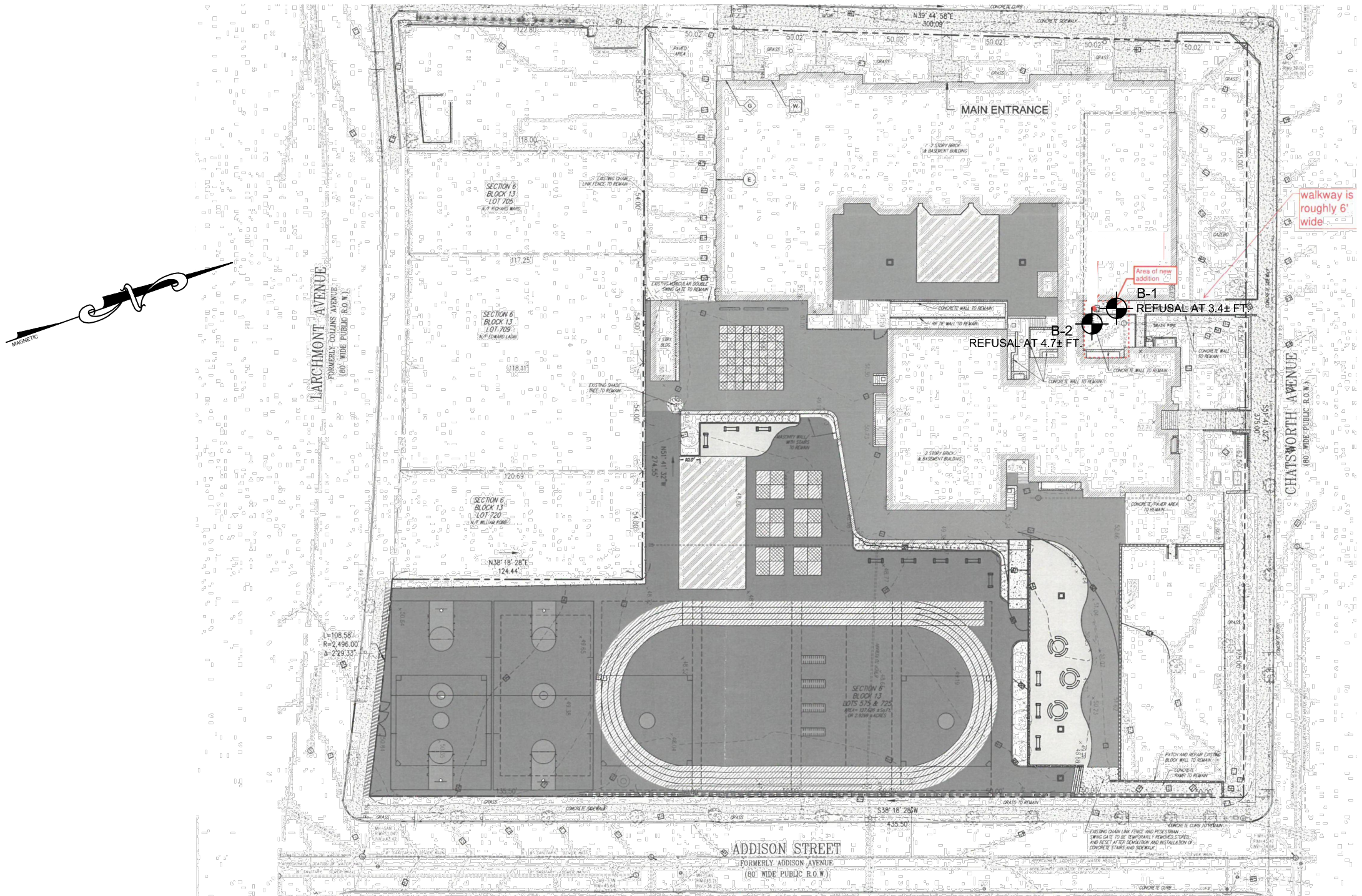
LEGEND:



B-1 - BORING NUMBER & APPROX. LOCATION

REFERENCE

1. SITE PLAN TAKEN FROM CHATSWORTH AVE. SCHOOL SITE PLAN PREPARED  
BY LAN ASSOCIATES, DATED 4/02/18



PROPOSED ADDITION  
CHATSWORTH AVE. ELEMENTARY SCHOOL  
34 CHATSWORTH AVENUE  
LARCHMONT, NEW YORK 10538

BORING LOCATION PLAN

**SESI**  
CONSULTING  
ENGINEERS D.P.C.


SOILS / FOUNDATIONS  
SITE DESIGN  
ENVIRONMENTAL

12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

dwg by: AAS  
chk by: FL  
scale: AS NOTED  
date: 11/20/19

job no: 10996  
drawing no:

**FIG-1**

				PROJECT NAME:		Chatsworth Avenue School		BORING NO.		B-1	
				LOCATION:		Larchmont NY		JOB NO.		10996	
				METHOD:		HSA/Auto Hammer		GROUND ELEVATION:		44'±	
BORING BY: AARCO				DATE STARTED:		11/2/2019		GROUNDWATER TABLE DEPTH			
INSPECTOR: ND				DATE COMPLETED:		11/2/2019		0 Hr. N.E. Date 11/2/2019		24 Hr. Date	
DEPTH (ft)	SAMPLE No.	REC (in)	DEPTH		Blows on Spoon				N (bl/ft)	SOIL DESCRIPTION AND STRATIFICATION	Symbol USCS
			FROM (ft)	TO (ft)	0/6	6/12	12/18	18/24			
0											
5	S-1	16	1		8	8			16	2"± of Asphalt Gray coarse to fine GRAVEL, and coarse to fine Sand, trace Silt, with Weathered Rock fragments (-200)=8.5% WC=3.0% Gray medium to fine SAND, trace Gravel, trace Silt, with Weathered Rock fragments	
				3			8	35			
	S-2	2	3	3.4	50/5"	-			-		
10										BORING COMPLETED @ 3.4± FEET DUE TO AUGER REFUSAL	
15											
20											
25											
30											
35											
40											


Nominal I.D. of Hole	in	The subsurface information shown hereon was obtained for the design and estimating purposes for our client. It is made available to authorized users only that they may have access to the same information available to our client. It is presented in good faith, but it is not intended as a substitute for investigations, interpretations or judgment of such authorized users. Information on the logs should not be relied upon without the geotechnical engineers recommendations contained in the report from which these logs were extracted.
Nominal I.D. of Split Barrel Sampler	1 3/4 in	
Weight/type of Hammer on Drive Pipe	300 lb	
Weight/type of Hammer on Split Barrel	140 lb	
Drop of Hammer on Drive Pipe	in	
Core Size	in	

Pp: Pocket Penetrometer; WOH: Weight of Hammer; WOR: Weight of Rod

Approximate Change in Strata: \_\_\_\_\_ Inferred Change in Strata: \_\_\_\_\_

Soil descriptions represent a field identification after D. M. Burmister unless otherwise noted.



				PROJECT NAME:		Chatsworth Avenue School		BORING NO.		B-2	
				LOCATION:		Larchmont NY		JOB NO.		10996	
				METHOD:		Tripod and Cat Head		GROUND ELEVATION:		48'±	
BORING BY: AARCO				DATE STARTED:		11/2/2019		GROUNDWATER TABLE DEPTH			
INSPECTOR: ND				DATE COMPLETED:		11/2/2019		0 Hr. N.E. Date 11/2/2019		24 Hr. Date	
DEPTH (ft)	SAMPLE No.	REC (in)	DEPTH		Blows on Spoon				N (bl/ft)	SOIL DESCRIPTION AND STRATIFICATION	Symbol USCS
			FROM (ft)	TO (ft)	0/6	6/12	12/18	18/24			
0											
5	S-1	20	1		21	21			51	7"± of Topsoil Gray/light brown coarse to fine GRAVEL, and coarse to fine Sand, trace Silt, with Weathered Rock fragments Same as above...	
				3			30	17			
	S-2	17	3		15	35			73		
				4.7			38	50/3"			
10										BORING COMPLETED @ 4.7± FEET DUE TO SPLIT-SPOON REFUSAL	
15											
20											
25											
30											
35											
40											

Nominal I.D. of Hole	in	The subsurface information shown hereon was obtained for the design and estimating purposes for our client. It is made available to authorized users only that they may have access to the same information available to our client. It is presented in good faith, but it is not intended as a substitute for investigations, interpretations or judgment of such authorized users. Information on the logs should not be relied upon without the geotechnical engineers recommendations contained in the report from which these logs were extracted.
Nominal I.D. of Split Barrel Sampler	1 3/4 in	
Weight/type of Hammer on Drive Pipe	300 lb	
Weight/type of Hammer on Split Barrel	140 lb	
Drop of Hammer on Drive Pipe	in	
Core Size	in	

Pp: Pocket Penetrometer; WOH: Weight of Hammer; WOR: Weight of Rod

Approximate Change in Strata: \_\_\_\_\_ Inferred Change in Strata: \_\_\_\_\_

Soil descriptions represent a field identification after D. M. Burmister unless otherwise noted.

FIGURE 3

## **Definitions of Identification Terms for Granular Soils**

Our experience has shown that the following field identification system, which is patterned somewhat after the Burmister System, permits a more detailed breakdown of the components within a soil sample than other identification systems allow. It also compels the supervising technician to examine a sample quite closely in order to accurately describe the components within the sample.

### **Principal Component** (All Capitalized)

- GRAVEL      More than 50% of the sample by weight is Gravel
- SAND        More than 50% of the sample by weight is Sand
- SILT         More than 50% of the sample by weight is Silt

### **Minor Component** (Proper Case)

- Gravel        Less than 50% of the sample by weight is Gravel
- Sand          Less than 50% of the sample by weight is Sand
- Silt            Less than 50% of the sample by weight is Silt

### **Proportion Terms**

- and            Component ranges from 35% to 50% of the sample by weight
- some          Component ranges from 20% to 35% of the sample by weight
- little         Component ranges from 10% to 20% of the sample by weight
- trace          Component ranges from 0% to 10% of the sample by weight

### **Size of Soil Components**

- Gravel
  - Coarse gravel ranges from 3 inches to 1 inch
  - Medium gravel ranges from 1 inch to 3/8 inch
  - Fine gravel ranges from 3/8 inch to No. 10 sieve
- Sand
  - Coarse sand ranges from No. 10 sieve to No. 30 sieve
  - Medium sand ranges from No. 30 sieve to No. 60 sieve
  - Fine sand ranges from No. 60 sieve to No. 200 sieve
- Silt
  - Material which passes the No. 200 sieve
- Clay
  - Material which passes the No. 200 sieve
  - Exhibits varying degrees of plasticity

### **Gradation Designations**

- Coarse to fine (c-f)      All fractions greater than 10% of the component
- Coarse to medium (c-m)    Less than 10% of the component is fine
- Medium to fine (m-f)      Less than 10% of the component is coarse
- Coarse (c)                Less than 10% of the component is medium and fine
- Medium (m)                Less than 10% of the component is coarse and fine
- Fine (f)                    Less than 10% of the component is coarse and medium

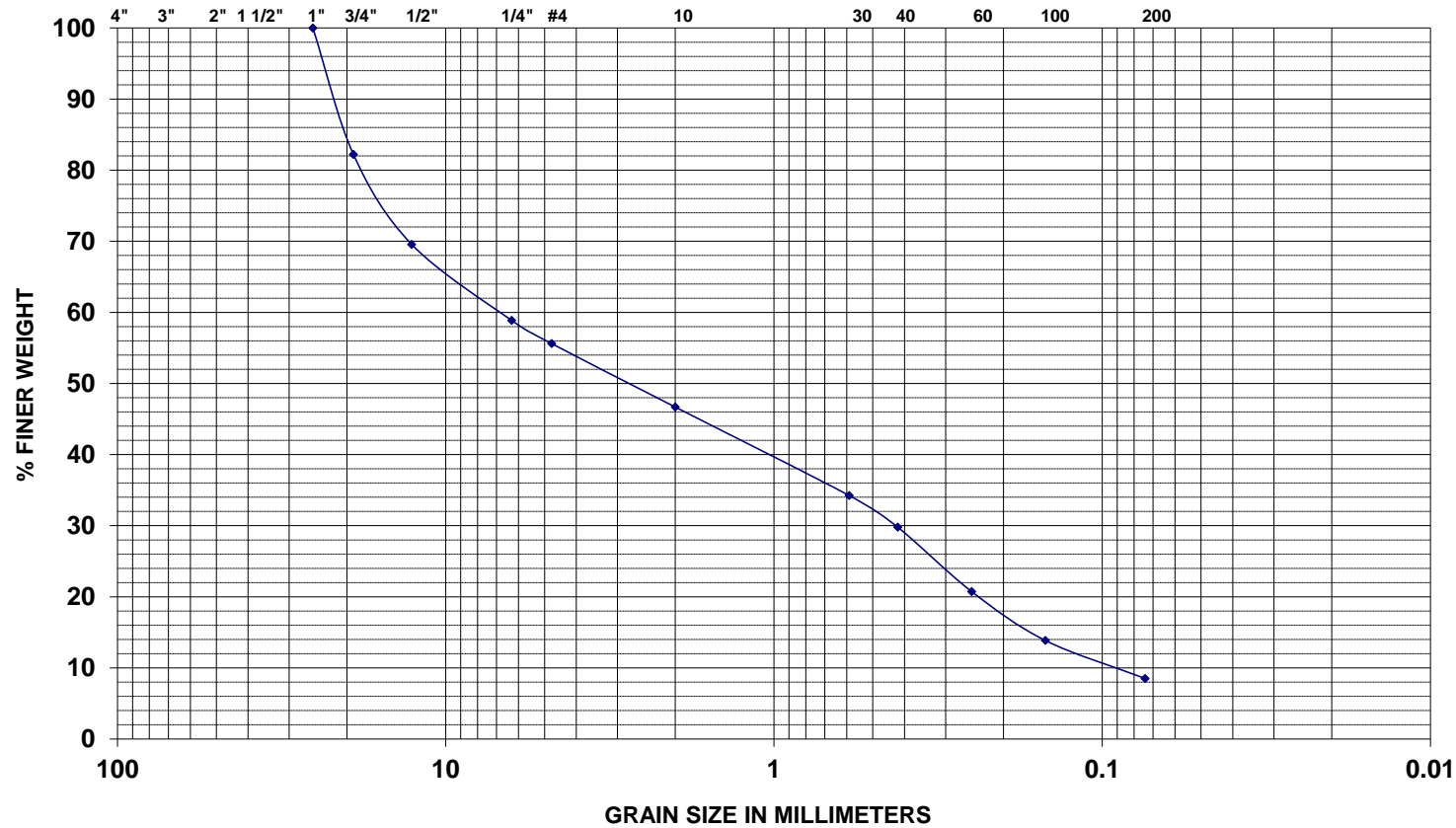
GRAVEL			SAND			SILT OR CLAY
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

3/4"

2mm

.074mm

U.S. STANDARD SIEVE SIZES



Symbol	◆	■	▲
Boring	B-1		
Sample	S-1		
Depth	1'-3'		
% +3"			
% Gravel	53.31		
% Sand	38.18		
% Fines	8.51		
% Silt			
% Clay			
Sp.G			
LL			
PL			
PI			
W (%)	3		

Particle Size Sieve #	Percent Finer Than		
3"	-		
1 1/2"	-		
1"	100.00		
3/4"	82.20		
1/2"	69.57		
1/4"	58.88		
4	55.62		
10	46.69		
30	34.24		
40	29.80		
60	20.74		
100	13.86		
200	8.51		

#### PARTICLE SIZE DISTRIBUTION

CLIENT: LAN Associates  
 PROJECT: Chatsworth Avenue School  
 DATE: November 6, 2019  
 JOB NO. 10996 FIGURE No 5

SYMBOL	DESCRIPTION AND REMARKS
◆	Gray coarse to fine GRAVEL, and coarse to fine Sand, trace Silt
■	
▲	

**SESI**  
 CONSULTING  
 ENGINEERS



FORMS TO BE SUBMITTED WITH BID  
(Submit All Forms With Bid In The Order They Are Listed Below)

The below list is provided for reference by the Bidder. However, such list shall not relieve the bidder of its obligation to review the specifications and submit all required documentation with its bid proposal.

**Section No.**

004101	Bid Proposal	<input type="checkbox"/>
004102	Bid Forms (GC, MC, PC, EC)	<input type="checkbox"/>
004390	Surety's Consent	<input type="checkbox"/>
004391	Certificate of Bidder	<input type="checkbox"/>
004392	Qualifications of Bidders	<input type="checkbox"/>
004393	Statement of Bidders Qualifications	<input type="checkbox"/>
004394	Bidder's Personnel	<input type="checkbox"/>
004395	Conflict of Interest Certificate	<input type="checkbox"/>
004396	Form of Disclosure Certificate	<input type="checkbox"/>
004397	Non-Collusion Affidavit	<input type="checkbox"/>
004398	Certification of Compliance with the Iran Divestment Act	<input type="checkbox"/>
004399	Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act	<input type="checkbox"/>
004400	Sexual Harassment Prevention Certification Form	<input type="checkbox"/>
004521	Hold Harmless Agreement	<input type="checkbox"/>
006101	Bid Bond	<input type="checkbox"/>
007316	Insurance Coverage Affidavit	<input type="checkbox"/>

**NOTES:**

1. Contractor must supply a street address. Post office box number is not acceptable.
2. All proposal forms, contract documents, etc. must be completed and signed in black ink only.
3. Please print the name of all signatory parties under the signature: Spell out name in full.
4. Affirmative action program documentation can be reviewed during regular business hours at the Mamaroneck Union Free School District, Mamaroneck, New York.
5. Wage rate documentation can be reviewed during regular business hours at the Mamaroneck Union Free School District, Mamaroneck, New York.



BID PROPOSAL

MAMARONECK UNION FREE SCHOOL DISTRICT

FOR THE **2019 BOND REFERENDUM /**  
**CAPITAL IMPROVEMENTS AT CHATSWORTH AVENUE SCHOOL**

Made this \_\_\_\_\_ Day of \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_  
(Corporation, Individual, or Partnership)

\_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

The party above named, as bidder, declares that the only person or persons interested in this bid or proposal as principal or principals is or are named above and that no other person(s) has an interest in this proposal or in the contract proposed to be taken; that this bid or proposal is not made with any person or persons making a bid or proposal for the same purpose; and that no officer or employee of the Mamaroneck Union Free School District, is or shall be, or will become, directly or indirectly interested as a contracting party, partner, stockholder, surety or otherwise in the performance of the contract, or in the supplies, work, that business to which it relates, or any portion of the profits thereof; that he has examined the site of the work, that he has examined the Contract Documents and the drawings therein referred to and has read the "Information to Bidders" hereto attached; and he proposes and agrees that this Proposal be accepted, that he will contract in the form provided for the **2019 BOND REFERENDUM/ CAPITAL IMPROVEMENTS AT CHATSWORTH AVENUE SCHOOL** to furnish all necessary labor, material, plant, power tools, equipment, supplies, and transportation, and perform all work mentioned in the contract documents for the following lump sum base bid price, alternates, and unit prices:

(SEE FOLLOWING PAGES AND FILL IN ALL INFORMATION REQUIRED.)



SECTION 004102 - BID FORM  
MAMARONECK UFSD  
2019 Bond Referendum  
Chatsworth Ave. School  
Contract #3a - General Construction  
State Plan #66-07-01-03-0-005-020

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #3a (GC): Base Bid</b>	
	<b>\$ (Total)</b>
<b>ALTERNATES:</b>	
<p><i>The following amounts proposed for identified work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner chooses to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents. Specification Section 012300 for Alternate descriptions.</i></p>	
<b>Add Alternate # 3a-1 - Floor Replacement – Nurse's Office</b>	+\$
<b>Add Alternate # 3a-2 - Sky Gym Renovations (Work Area "D")</b>	+\$
<b>UNIT PRICES:</b>	
<p><i>Should the contract work be increased or decreased as per the General Conditions of the Contract, Article 8, Changes in the Work, the bidder hereby agrees that the following unit price is the basis for the extra or the credit. The price includes all labor, material, overhead, profit, administration, insurance, applicable taxes, and incidental or contributory items, or cost to the contractor and/or suppliers in connection therewith. The undersigned agrees to the following prices stipulated below as the amount of extra or credit to be applied to the contract for the increase or decrease in the scope of work if required during the course of the project. Refer to Specification Section 012200 for Unit Price descriptions.</i></p>	
<b>Unit Price #3a-1 - Asbestos – Large Project Decon</b>	\$ /unit
<b>Unit Price #3a-2 - Asbestos – Small Project Decon</b>	\$ /unit
<b>Unit Price #3a-3 – Asbestos – OSHA Wash Station for Minor Project</b>	\$ /unit
<b>Unit Price #3a-4 – Site/Civil Rock Removal</b>	\$ /CY
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
<b>No.1</b>	<b>No.2</b>
<b>No.3</b>	<b>No.4</b>
<b>No.5</b>	<b>No.6</b>
<b>No.7</b>	<b>No.8</b>
<b>REFER TO PAGE SECTION 004100 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows:</p> <ul style="list-style-type: none"> <li>•If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</li> <li>•If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.</li> </ul> <p>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.</p> <p>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</p> <p>2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SECTION 004102 - BID FORM  
MAMARONECK UFSD  
2019 Bond Referendum  
Chatsworth Ave. School  
Contract #3b - Mechanical  
State Plan #66-07-01-03-0-005-020

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #3b (Mechanical): Base Bid</b>	
<b>\$</b>	<b>(Total)</b>
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004100 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</p> <p>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law.</p> <p>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</p> <p>2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	





SECTION 004102 - BID FORM  
MAMARONECK UFSD  
2019 Bond Referendum  
Chatsworth Ave. School  
Contract #3c - Plumbing  
State Plan #66-07-01-03-0-005-020

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #3c (Plumbing): Base Bid</b>	<b>\$ (Total)</b>
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004100 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</p> <p>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law.</p> <p>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</p> <p>2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SECTION 004102 - BID FORM  
MAMARONECK UFSD  
2019 Bond Referendum  
Chatsworth Ave. School  
Contract #3d - Electrical  
State Plan #66-07-01-03-0-005-020

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #3d (Electrical): Base Bid</b>	
<b>\$</b>	<b>(Total)</b>
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004100 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). <i>Method of Award: Award of Contract may be made to the Lowest Responsible Bidder on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</i></p> <p><i>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law.</i></p> <p><i>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</i></p> <p>2). <i>On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</i></p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SURETY'S CONSENT

MAMARONECK UNION FREE SCHOOL DISTRICT

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ a  
Corporation of the State of \_\_\_\_\_ having its principal office at  
\_\_\_\_\_ and \_\_\_\_\_ a Company/  
Corporation in the State of \_\_\_\_\_ having its principal office at  
\_\_\_\_\_ being (a) surety company (is)  
qualified to do business in the State of New York in consideration of the premises and of One Dollar to it  
(them) in hand paid by the Owner, and of other good and valuable considerations, the receipt thereof is  
hereby acknowledged, do (es) consent and agree, that if the contract for which the preceding bid or  
proposal is made be awarded to the person or persons making the security, for the full and faithful  
performance of said work, and, for the protection of all persons performing or furnishing labor or materials  
for the performance of said contract in the form required; the performance bond and the labor and  
material obligations to be in an amount equal to 100% of the contract price, and to be conditioned so as  
to indemnify the Owner against loss due to the failure of the Contractor to meet the stipulations of said  
bond; and if the said person or persons shall omit or refuse to execute such contract and give the proper  
security within ten (10) days after written notice that same is ready for execution, if so awarded, and if  
sum, which the Owner may be obliged to pay to the person or persons by whom the contract shall be  
finally executed, exceeds the sum to which the person or persons making this bid or proposal would be  
entitled, then, the said surety company or companies will pay, without proof of notice or demand, to the  
Owner the amount of any such excess; the sums in each case to be calculated upon the estimated  
quantities of work, labor and materials by which the bids are tested.

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Surety

\_\_\_\_\_  
As To Surety

\_\_\_\_\_  
By Attorney



CERTIFICATE OF BIDDER  
MAMARONECK UNION FREE SCHOOL DISTRICT

Pursuant to the laws of the State of New York, the undersigned does herewith certify to the Owner that it owns, leases or controls all of the necessary equipment required to perform the work shown and described on the plans, specifications, and contract drawings for the **2019 BOND REFERENDUM/ CAPITAL IMPROVEMENTS AT CHATSWORTH AVENUE SCHOOL.**

The undersigned does further certify to the Owner that it is financially responsible and financially capable of accomplishing the work to be performed under the said contract above mentioned.

The undersigned does further certify to the Owner that it is fully qualified to perform the work under the said contract above mentioned.

IN WITNESS WHEREOF, the undersigned has caused this Certificate to be executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
President

Sworn and subscribed to  
before me this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public





## QUALIFICATIONS OF BIDDERS

**Experience and Qualifications of the Bidder:** Each bidder is required to submit the following documentation to demonstrate its experience and qualifications for the work of the Project for which a bid is submitted:

- a. A description of its experience with projects of comparative size, complexity, and cost, together with documentary evidence showing that said projects were completed to the Owner's satisfaction and were completed in a timely fashion;
- b. Documentation from each of the projects it has performed capital work in the last five (5) years concerning the bidder's:
  - (i) timeliness of performance of the work of the project
  - (ii) evidence that the project was completed to the Owner's satisfaction;
  - (iii) whether or not any extensions of time were requested by the contractor and whether or not such requests were granted;
  - (iv) whether litigation and/or arbitration was commenced by either the Owner or the bidder as a result of the work of the project performed by the bidder;
  - (v) whether any liens were filed on the project by subcontractors or material suppliers of the bidder;
  - (vi) whether the bidder was defaulted on the project by the owner;
  - (vii) whether the bidder made any claims for extra work on the project, including whether said claim resulted in a change order;
- c. Documentation evidencing the bidder's financial responsibility, including a certified financial statement prepared by a certified public accountant.
- d. Documentation evidencing the bidder's existence under the same name for the last five (5) years.
- e. Documentation evidencing the bidder's Worker's Compensation Experience Modification.



## STATEMENT OF BIDDER'S QUALIFICATIONS

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE ANSWER TO ALL OF THE QUESTIONS IN THIS STATEMENT. IN THE EVENT A COMPLETE ANSWER IS NOT PROVIDED, THE BID WILL BE REJECTED.**

1. Name of Bidder

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2. Type of Business Entity

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3. If the bidder is a corporation, state the date and place of incorporation of the corporation.

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4. For how many years has the bidder done business under its present name?

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5. List the persons who are directors, officers, owners, managerial employees or partners in the bidder's business.

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6a. Have any of the persons listed in Number 5 owned/operated/been shareholders in any other companies? If so, please state name of owned/operated/been shareholders and names of other companies:

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6b. If the answer to number 6a is in the affirmative, list said persons and the names of their previous affiliations.

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7. Has any director, officer, owner or managerial employee had any professional license suspended or revoked? If the answer to this question is yes, list the name of the individual, the professional license he/she formerly held, whether said license was revoked or suspended and the date of the revocation or suspension.

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8. Has the bidder been found guilty of any OSHA Violations? If the answer to this question is yes, describe the nature of the OSHA violation, an explanation of remediation or other steps taken regarding such violation(s).

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9. Has the bidder been charged with any claims pertaining to unlawful intimidation or discrimination against any employee by reason of race, creed, color, disability, sex or natural origin and/or violations of an employee's civil rights or equal employment opportunities? If the answer to this question is yes, list the persons making such claim against the bidder, a description of the claim, the status of the claim, and what disposition (if any) has been made regarding such claim.

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10. Has the bidder been named as a party in any lawsuit arising from performance of work related to any project in which it has been engaged? If the answer to this question is yes, list all such lawsuits, the index number associated with said suit and the status of the lawsuit at the time of the submission of this bid.

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11. Has the bidder been the subject of an investigation and/or proceedings before the Department of Labor for alleged violations of the Labor Law as it relates to the payment of prevailing wages and/or supplemental payment requirements? If the answer to this question is yes, please list each such instance of the commencement of a Department of Labor proceeding, for which project such proceeding was commenced, and the status of the proceeding at the time of the submission of this bid.

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12. Has the bidder been the subject of an investigation and/or proceeding before any law enforcement agency, including, but not limited to any District Attorney's Office? If the answer to this question is yes, please list each such instance, the law enforcement agency, the nature of the proceeding, the project for which such proceeding was commenced, if applicable to a project, and the status of the proceeding at the time of the submission of this bid.

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13. Has the bidder been the subject of proceedings involving allegations that it violated the Workers' Compensation Law including but not limited to the failure to provide proof of worker's compensation or disability coverage and/or any lapses thereof. If the answer to this question is yes, list each such instance of violation and the status of the claimed violation at the time of the submissions of this bid.

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\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

14. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment? If the answer to this question is yes, list the name of the individual convicted or indicted, the charge against the individual and the date of disposition of the charge.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

15. Has the bidder been charged with and/or found guilty of any violations of federal, state, or municipal environmental and/or health laws, codes, rules and/or regulations? If the answer to this question is yes, list the nature of the charge against the bidder, the date of the charge, and the status of the charge at the time of the submission of this bid.



16. Has the bidder bid on any projects for the period September 1, 2012 to present? If the answer to this question is yes, list the projects bid on, whether said bid was awarded to the bidder and the expected date of commencement of the work for said project. For those projects listed, if the bidder was not awarded the contract, state whether the bidder was the lowest monetary bidder.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #16 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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17. Does the bidder have any projects ongoing at the time of the submission of this bid? If the answer to this question is yes, list the projects on which the bidder is currently working, the percentage complete, and the expected date of completion of said project.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #17 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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18. Has the bidder ever been terminated from a Project by the Owner? If the answer to this question is yes, list the projects on which the bidder was terminated, the nature of the termination (convenience, suspension, for cause), and the date of said termination.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #18 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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19. Has the bidder's surety ever been contacted to provide supervisory services in connection with an on-going project. If the answer to this question is yes, list the project(s) for which the surety provided supervisory services.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #19 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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20. Bidder's Worker's Compensation Experience Modifier: \_\_\_\_\_

Dated:

By: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name and Title)

Sworn to before me this  
\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Notary Public





BIDDER'S PERSONNEL  
MAMARONECK UNION FREE SCHOOL DISTRICT

Give names of all officers of the corporation:

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Give the names of the executive, principal, or superintendent who will give personal attention to the work wherever required:

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## CONFLICT OF INTEREST CERTIFICATE

Pursuant to Section 2:4-15 of the Administrative Code of the State of New York, the undersigned does herewith certify that no officer or employee is interested in this contract, nor shall he participate in any profits with the undersigned or any other person, or receive any compensation, commission, gift, or other reward for his services, except the salary or fees established by law or by ordinance or resolution of the council.

IN WITNESS WHEREOF, the undersigned has  
caused this certificate to be executed this \_\_\_\_\_  
day of \_\_\_\_\_, \_\_\_\_\_.

Sworn and subscribed to before me this \_\_\_\_\_  
day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
President  
(Or Authorized Agent of Corporation)

\_\_\_\_\_  
Secretary



**-FORM OF DISCLOSURE-**

THE UNDERSIGNED AFFIRMS THAT THE FOLLOWING CONSTITUTE ALL OFFICERS, DIRECTORS, PARTNERS, OR CONTROLLING PRINCIPALS OF THE FIRM:

Name

Title

_____	_____
_____	_____

1. Does any School District Board Member, administrator, or employee possess any financial interest, directly or indirectly, in the firm?\_\_\_\_\_ If yes, set forth the basis upon which a financial interest exists in the firm:

\_\_\_\_\_  
\_\_\_\_\_

2. Has the firm or any of its officers, directors, partners, or controlling principals possessed any interest in transactions heretofore entered into with the School District?\_\_\_\_\_ If yes, please describe transaction(s):

\_\_\_\_\_  
\_\_\_\_\_

3. Does any direct relative of a member of the Board, administrators, or staff possess any financial interest, directly or indirectly, in the firm (For purpose of this inquiry a direct relative is to be defined as a parent, spouse, child or sibling).\_\_\_\_\_ If yes, set forth below the School District Board Member, administrator, or staff member whose relation possess an interest and the relationship:

\_\_\_\_\_  
\_\_\_\_\_

THE UNDERSIGNED AFFIRMS THAT THE ABOVE STATEMENTS ARE TRUE AND UNDERSTANDS THAT ANY FALSE STATEMENT SHALL CONSTITUTE A VIOLATION OF THE PENAL CODE OR GENERAL MUNICIPAL LAW AS APPLICABLE.

Firm: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_



**NON-COLLUSIVE FORM**  
**BID PROPOSAL CERTIFICATIONS**

Firm Name \_\_\_\_\_

Business Address \_\_\_\_\_

Telephone Number \_\_\_\_\_ Date of Bid \_\_\_\_\_

**I. General Bid Certification**

The bidder certifies that he will furnish, at the prices quoted, the materials, equipment and/or services as proposed on this Bid.

**II. Non-Collusive Bidding Certification**

The following statement is made pursuant to Section 103-D of the General Municipal Law, as amended by Chapter 675 of the Laws of 1966, and Section 139-D of the State Finance Law, as amended by Chapter 675 of the Laws of 1966, and Section 2604 of the Public Authorities Law, as amended by Chapter 675 of the Laws of 1966.

By submission of this bid proposal, the bidder certifies that he/she is complying with Section 103-d of the General Municipal Law as follows:

Statement of non-collusion in bids and proposals to political subdivision of the state. Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation, or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

Non-collusive bidding certification.

A(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;





2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,

3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

- (b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided, however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the reasons therefor. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department agency or official thereof to which the bid is made or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certifications referred to in subdivision II of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing, and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of corporation.

**The bidder affirms the above statement as true under the penalties of perjury.**

Signature of Bidder: \_\_\_\_\_  
(Signature of bidder or authorized representative of a corporation)

Title: \_\_\_\_\_

Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_



**CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT**

As a result of the Iran Divestment Act of 2012 (the "Act"), Chapter 1 of the 2012 Laws of New York, a new provision has been added to State Finance Law (SFL) § 165-a and New York General Municipal Law § 103-g, both effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list of "persons" who are engaged in "investment activities in Iran" (both are defined terms in the law) (the "Prohibited Entities List"). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act's effective date at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, each Bidder/Contractor, any person signing on behalf of any Bidder/Contractor and any assignee or subcontractor and, in the case of a joint bid, each party thereto, certifies, under penalty of perjury, that once the Prohibited Entities List is posted on the OGS website, that to the best of its knowledge and belief, that each Bidder/Contractor and any subcontractor or assignee is not identified on the Prohibited Entities List created pursuant to SFL § 165-a(3)(b).

Additionally, Bidder/Contractor is advised that once the Prohibited Entities List is posted on the OGS Website, any Bidder/Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to this solicitation must certify at the time the Contract is renewed, extended or assigned that it is not included on the Prohibited Entities List.

During the term of the Contract, should the School District receive information that a Bidder/Contractor is in violation of the above-referenced certification, the School District will offer the person or entity an opportunity to respond. If the person or entity fails to demonstrate that he/she/it has ceased engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then the School District shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages or declaring the Bidder/Contractor in default. The School District reserves the right to reject any bid or request for assignment for a Bidder/Contractor that appears on the Prohibited Entities List prior to the award of a contract and to pursue a responsibility review with respect to any Bidder/Contractor that is awarded a contract and subsequently appears on the Prohibited Entities List.

I, \_\_\_\_\_, being duly sworn, deposes and says that he/she is the \_\_\_\_\_ of the \_\_\_\_\_ Corporation and that neither the Bidder/ Contractor nor any proposed subcontractor is identified on the Prohibited Entities List.

\_\_\_\_\_  
SIGNED

SWORN to before me this

\_\_\_\_\_ day of \_\_\_\_\_

201\_\_\_\_

Notary Public: \_\_\_\_\_



**DECLARATION OF BIDDER'S INABILITY TO PROVIDE CERTIFICATION OF COMPLIANCE  
WITH THE IRAN DIVESTMENT ACT**

*Bidders shall complete this form if they cannot certify that the bidder /contractor or any proposed subcontractor is not identified on the Prohibited Entities List. The District reserves the right to undertake any investigation into the information provided herein or to request additional information from the bidder.*

Name of the Bidder: \_\_\_\_\_

Address of Bidder: \_\_\_\_\_

Has bidder been involved in investment activities in Iran? \_\_\_\_\_  
Describe the type of activities including but not limited to the amounts and the nature of the investments  
(e.g. banking, energy, real estate) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If so, when did the first investment activity occur? \_\_\_\_\_

Have the investment activities ended? \_\_\_\_\_

If so, what was the date of the last investment activity? \_\_\_\_\_

If not, have the investment activities increased or expanded since April 12, 2012? \_\_\_\_\_

Has the bidder adopted, publicized, or implemented a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran? \_\_\_\_\_

If so, provide the date of the adoption of the plan by the bidder and proof of the adopted resolution, if any and a copy of the formal plan. \_\_\_\_\_

In detail, state the reasons why the bidder cannot provide the Certification of Compliance with the Iran Divestment Act below (additional pages may be attached):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I, \_\_\_\_\_ being duly sworn, deposes and says that he/she is the \_\_\_\_\_ of  
the \_\_\_\_\_ Corporation and the foregoing is true and accurate.

\_\_\_\_\_  
SIGNED

SWORN to before me this

\_\_\_\_\_ day of \_\_\_\_\_

201\_\_\_\_

Notary Public: \_\_\_\_\_



## Sexual Harassment Prevention Certification Form

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

Bidder Name: \_\_\_\_\_

Bidder Address: \_\_\_\_\_

Signature: \_\_\_\_\_

Print Name and Title: \_\_\_\_\_

Date: \_\_\_\_\_





**HOLD HARMLESS AGREEMENT**

In accordance with Article 12 of the General Conditions, Indemnification, the Contractor will be required to sign the following "Hold Harmless" Agreement with the BOARD OF EDUCATION. Compliance with the foregoing requirements for insurance shall not relieve the Contractor from liability set forth under the Indemnity Agreement.

The undersigned hereby agrees to defend, indemnify, and save harmless the BOARD OF EDUCATION, its officers and employees from and against any and all liability, loss, damages, claims for bodily injury and/or property damages, cost and expense, including counsel fees, to the extent permissible by law, that may occur or that may be alleged to have occurred in the course of the performance of this agreement by the contractor, whether such claims shall be made by an employee of the contractor or by a third party, the contractor covenants and agrees that he will pay all costs and expenses arising therefrom and in connection therewith, and if any judgment shall be rendered against the Owner, Architect/Engineer and Construction Manager, in any such litigation, the Contractor shall at his own expense satisfy and discharge the same.

By: \_\_\_\_\_  
(Signature of Authorized Representative of Corporation)

\_\_\_\_\_  
(Print Name and Title)

\_\_\_\_\_  
(Date)



# **New York State Prevailing Wage Rates**





Andrew M. Cuomo, Governor

Roberta Reardon, Commissioner

Mamaroneck Union Free School D

Veronica Moreno, LAN Associates  
252 Main Street  
2nd Floor  
Goshen NY 10924

Schedule Year 2020 through 2021  
Date Requested 11/05/2020  
PRC# 2020011331

Location Chatsworth Avenue School  
Project ID# 4.1092.72.03  
Project Type 2019 Bond Referendum Capital Improvements at Chatsworth Avenue School

### PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2020 through June 2021. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website [www.labor.ny.gov](http://www.labor.ny.gov). Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

#### NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: \_\_\_\_\_ Date Cancelled: \_\_\_\_\_

Name & Title of Representative: \_\_\_\_\_

Phone: (518) 457-5589 Fax: (518) 485-1870  
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240



# **General Provisions of Laws Covering Workers on Article 8 Public Work Contracts**

## **Introduction**

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

## **Responsibilities of the Department of Jurisdiction**

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission; a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion [online](#).

## **Hours**

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

There are very few exceptions to this rule. Complete information regarding these exceptions is available on the ["Request for a dispensation to work overtime" form \(PW30\)](#) and ["4 Day / 10 Hour Work Schedule" form \(PW 30.1\)](#).

## **Wages and Supplements**

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12240; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website [www.labor.ny.gov](http://www.labor.ny.gov).

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website [www.labor.ny.gov](http://www.labor.ny.gov).

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website [www.labor.ny.gov](http://www.labor.ny.gov).

## **Payrolls and Payroll Records**

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid

or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment. Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed \$100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds \$25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

### **Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties**

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

### **Withholding of Payments**

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

### **Summary of Notice Posting Requirements**

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.



The "Public Work Project" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers' compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

## **Apprentices**

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeymen in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyman's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12240 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

## **Interest and Penalties**

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

## **Debarment**

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

## **Criminal Sanctions**

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

## **Discrimination**

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b) ).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of \$50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c) ).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d) ).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

### **Workers' Compensation**

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

### **Unemployment Insurance**

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.



Andrew M. Cuomo, Governor

Roberta Reardon, Commissioner

Mamaroneck Union Free School D

Veronica Moreno, LAN Associates  
252 Main Street  
2nd Floor  
Goshen NY 10924

Schedule Year 2020 through 2021  
Date Requested 11/05/2020  
PRC# 2020011331

Location Chatsworth Avenue School  
Project ID# 4.1092.72.03  
Project Type 2019 Bond Referendum Capital Improvements at Chatsworth Avenue School

### Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

### Contractor Information

All information must be supplied

Federal Employer Identification Number: _____		
Name: _____		
Address: _____ _____		
City: _____	State: _____	Zip: _____
Amount of Contract: \$ _____	Contract Type:	
Approximate Starting Date: ____/____/____	<input type="checkbox"/> (01) General Construction	
Approximate Completion Date: ____/____/____	<input type="checkbox"/> (02) Heating/Ventilation	
	<input type="checkbox"/> (03) Electrical	
	<input type="checkbox"/> (04) Plumbing	
	<input type="checkbox"/> (05) Other : _____	

Phone: (518) 457-5589 Fax: (518) 485-1870  
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240



### **Social Security Numbers on Certified Payrolls:**

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

### **Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d**

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to \$1,500 for a first offense and up to \$5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, [www.labor.ny.gov](http://www.labor.ny.gov). <https://labor.ny.gov/formsdocs/ui/IA999.pdf>

If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: [dol.misclassified@labor.ny.gov](mailto:dol.misclassified@labor.ny.gov).

### **Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)**

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage rate* for their particular job classification *on each pay stub*\*. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website [www.labor.ny.gov](http://www.labor.ny.gov) or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. \*In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

**To all State Departments, Agency Heads and Public Benefit Corporations  
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

## **Budget Policy & Reporting Manual**

# **B-610**

### **Public Work Enforcement Fund**

*effective date December 7, 2005*

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#### **1. Purpose and Scope:**

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

#### **2. Background and Statutory References:**

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

#### **3. Procedures and Agency Responsibilities:**

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

**To all State Departments, Agency Heads and Public Benefit Corporations**  
**IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor  
Administrative Finance Bureau-PWEF Unit  
Building 12, Room 464  
State Office Campus  
Albany, NY 12240

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.







Required Notice under Article 25-B of the Labor Law

**Attention All Employees, Contractors and Subcontractors:  
You are Covered by the Construction Industry Fair Play Act**

**The law says that you are an employee unless:**

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

**It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.**

**Employee Rights:** If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

**Independent Contractors:** If you are an independent contractor, **you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

**Penalties** for paying workers off the books or improperly treating employees as independent contractors:

- **Civil Penalty**
  - First offense: Up to \$2,500 per employee
  - Subsequent offense(s): Up to \$5,000 per employee
- **Criminal Penalty**
  - First offense: Misdemeanor - up to 30 days in jail, up to a \$25,000 fine and debarment from performing public work for up to one year.
  - Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a \$50,000 fine and debarment from performing public work for up to 5 years.

**If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to [dol.misclassified@labor.ny.gov](mailto:dol.misclassified@labor.ny.gov). All complaints of fraud and violations are taken seriously. You can remain anonymous.**

**Employer Name:**

IA 999 (09/16)



# Attention Employees

## THIS IS A: **PUBLIC WORK PROJECT**

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Chapter 629 of  
the Labor Laws  
of 2007:

**These wages are set by law and must be posted  
at the work site. They can also be found at:**  
[www.labor.ny.gov](http://www.labor.ny.gov)

If you feel that you have not received proper wages or benefits,  
please call our nearest office.\*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5156		

\* For New York City government agency construction projects, please  
contact the Office of the NYC Comptroller at (212) 669-4443, or  
[www.comptroller.nyc.gov](http://www.comptroller.nyc.gov) – click on Bureau of Labor Law.

Contractor Name: \_\_\_\_\_

Project Location: \_\_\_\_\_



## Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is \$250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training "prior to the performing any work on the project."

### The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.*)
- Training roster, attendance record or other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

\*\*A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

## WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is \$3 million in Bronx, Kings, New York, Queens and, Richmond counties; \$1.5 million in Nassau, Suffolk and Westchester counties; and \$500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirements on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

## Introduction to the Prevailing Rate Schedule

### Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

#### Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

#### Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

#### Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

#### Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

#### Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

#### Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website ([www.labor.ny.gov](http://www.labor.ny.gov)) for current wage rate information.

#### Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor  
Bureau of Public Work  
State Office Campus, Bldg. 12  
Albany, NY 12240

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

## Westchester County General Construction

<b>Boilermaker</b>	<b>11/01/2020</b>
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### JOB DESCRIPTION Boilermaker

**DISTRICT 4**

#### ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

#### WAGES

Per Hour: 07/01/2020 01/01/2021

Boilermaker	\$ 61.24	\$63.38
Repairs & Renovations	61.24	63.38

#### SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2020 01/01/2021

Boilermaker	32% of hourly	32% of hourly
Repair \$ Renovations	Wage Paid	Wage Paid
	+ \$ 25.35	+ TBA

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

#### OVERTIME PAY

See (D, O) on OVERTIME PAGE

Repairs & Renovation see (B,E,Q)

#### HOLIDAY

Paid: See (8, 16, 23, 24) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 12, 15, 16, 22, 23, 24, 25) on HOLIDAY PAGE

NOTE: \*Employee must work in pay week to receive Holiday Pay.

\*\*Employee gets 4 times the hourly wage rate for working Labor Day.

#### REGISTERED APPRENTICES

Wage per hour:

(1/2) Year Terms at the following percentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th
65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

	07/01/2020	01/01/2021
Apprentice(s)	32% of Hourly	32% of Hourly
	Wage Paid Plus	Wage Paid Plus
	Amount Below	Amount Below

1st Term	\$ 19.38	\$ TBA
2nd Term	20.24	TBA
3rd Term	21.08	TBA
4th Term	21.94	TBA
5th Term	22.79	TBA
6th Term	23.65	TBA
7th Term	24.48	TBA

NOTE: "Hourly Wage Paid" shall include any and all premium(s)

4-5

<b>Carpenter</b>	<b>11/01/2020</b>
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### JOB DESCRIPTION Carpenter

**DISTRICT 8**

#### ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

#### WAGES

Per hour: 07/01/2020

Piledriver	\$ 55.93
Dockbuilder	\$ 55.93



## SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 52.44

## OVERTIME PAY

See (B, E2, O) on OVERTIME PAGE

## HOLIDAY

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

## REGISTERED APPRENTICES

Wages per hour

(1)year terms:

1st	2nd	3rd	4th
\$22.37	\$27.97	\$36.35	\$44.74

Supplemental benefits per hour:

All Terms: \$ 34.34

8-1556 Db

## Carpenter

11/01/2020

**JOB DESCRIPTION** Carpenter

**DISTRICT** 8

## ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

## WAGES

Per hour: 07/01/2020

Carpet/Resilient

Floor Coverer \$ 54.00

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

## SUPPLEMENTAL BENEFITS

Per hour:

\$ 46.99

## OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

## HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE.

Paid for 1st & 2nd yr.

Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

## REGISTERED APPRENTICES

Wage per hour - (1) year terms:

1st	2nd	3rd	4th
\$24.20	\$27.20	\$31.45	\$39.33

Supplemental benefits per hour:

1st	2nd	3rd	4th
\$16.06	\$17.56	\$21.16	\$23.16

8-2287

## Carpenter

11/01/2020

**JOB DESCRIPTION** Carpenter

**DISTRICT** 8

## ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

## WAGES

Per Hour: 07/01/2020

Marine Construction:

Marine Diver	\$ 70.80
Marine Tender	50.34

## SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker \$ 52.34

## OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

## HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE

Overtime: See (5, 6, 10, 11, 13, 16, 18, 19) on HOLIDAY PAGE

## REGISTERED APPRENTICES

Wages per hour:

One (1) year terms.

1st year	\$ 22.37
2nd year	27.97
3rd year	36.35
4th year	44.74

Supplemental Benefits

Per Hour:

All terms \$ 34.34

8-1456MC

## Carpenter

11/01/2020

**JOB DESCRIPTION** Carpenter

**DISTRICT** 8

## ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

## WAGES

Per hour: 07/01/2020

Building	
Millwright	\$ 55.70

## SUPPLEMENTAL BENEFITS

Per hour:

Millwright \$ 54.16

## OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

## HOLIDAY

Paid: See (18,19) on HOLIDAY PAGE.

Overtime See (5,6,8,11,13,18,19,25) on HOLIDAY PAGE.

## REGISTERED APPRENTICES

Wages per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
\$29.99	\$35.44	\$40.89	\$51.79

Supplemental benefits per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
------	------	------	------

\$34.79      \$38.49      \$42.84      \$49.60

8-740.1

**Carpenter**

**11/01/2020**

**JOB DESCRIPTION** Carpenter

**DISTRICT 8**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

**WAGES**

Per Hour:

07/01/2020

Timberman

\$ 51.05

**SUPPLEMENTAL BENEFITS**

Per Hour:

07/01/2020

\$ 51.79

**OVERTIME PAY**

See (B, E, E2, Q) on OVERTIME PAGE

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

**REGISTERED APPRENTICES**

Wages per hour:

One ( 1 ) year terms:

1st	2nd	3rd	4th
\$20.42	\$25.53	\$33.18	\$40.84

Supplemental benefits per hour:

All terms \$ 34.07

8-1556 Tm

**Carpenter**

**11/01/2020**

**JOB DESCRIPTION** Carpenter

**DISTRICT 8**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

**PARTIAL COUNTIES**

Orange: South of but including the following, Waterloo Mills, Slate Hill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.

Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.

Suffolk: West of Port Jefferson and Patchogue Road to Route 112 to the Atlantic Ocean.

**WAGES**

Per hour: 07/01/2020 10/18/2020

Core Drilling:

Driller \$ 41.19 \$ 41.74

Driller Helper 32.62 32.92

Note: Hazardous Waste Pay Differential:

For Level C, an additional 10% above wage rate per hour

For Level B, an additional 10% above wage rate per hour

For Level A, an additional 10% above wage rate per hour

Note: When required to work on water: an additional \$ 0.50 per hour.

**SUPPLEMENTAL BENEFITS**

Per hour:

Driller and Helper \$ 27.95

## OVERTIME PAY

OVERTIME: See (B,E,K\*,P,R\*\*) on OVERTIME PAGE.

## HOLIDAY

Paid: See (5,6) on HOLIDAY PAGE.

Overtime: \* See (5,6) on HOLIDAY PAGE.

\*\* See (8,10,11,13) on HOLIDAY PAGE.

8-1536-CoreDriller

## Carpenter - Building / Heavy&Highway

11/01/2020

**JOB DESCRIPTION** Carpenter - Building / Heavy&Highway

**DISTRICT** 11

## ENTIRE COUNTIES

Putnam, Rockland, Westchester

## WAGES

WAGES:(per hour)

	07/01/2020	07/01/2021
BUILDING/HEAVY & HIGHWAY/TUNNEL:		Additional
Carpenter	\$ 45.30	\$ 0.40

SHIFT DIFFERENTIAL: When it is mandated by a Government Agency irregular or off shift can be worked. The Carpenter shall receive an additional fifteen percent (15%) of wage plus applicable benefits.

NOTE: Carpenters employed in the removal or abatement of asbestos or any toxic or hazardous material or required to work near asbestos or any toxic or hazardous material and required to wear protective equipment shall receive two (2) hours extra pay per day, plus applicable supplemental benefits.

## SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 31.53

## OVERTIME PAY

BUILDING:

See ( B, E, Q ) on OVERTIME PAGE.

HEAVY&HIGHWAY/TUNNEL:

See ( B, E, P, \*R, \*\*T, X ) on OVERTIME PAGE.

\*R applies to Heavy&Highway/Tunnel Overtime Holiday Code 25 with benefits at straight time rate.

\*\*T applies to Heavy&Highway/Tunnel Overtime Holiday Codes 5 & 6 with benefits at straight time rate.

## HOLIDAY

BUILDING:

Paid: See ( 1 ) on HOLIDAY PAGE.

Overtime: See ( 5, 6, 16, 25 ) on HOLIDAY PAGE.

Holidays that fall on Sunday will be observed Monday.

HEAVY&HIGHWAY/TUNNEL:

Paid: See ( 5, 6, 25 ) on HOLIDAY PAGE including benefits.

Overtime: See ( 5, 6, 25 ) on HOLIDAY PAGE.

## REGISTERED APPRENTICES

1 year terms at the following wage rates:

Indentured after July 1 2016

1st	2nd	3rd	4th	5th
\$ 22.40	\$ 26.16	\$ 28.05	\$ 29.93	\$ 33.70

Indentured before July 1 2016

1st	2nd	3rd	4th
\$ 22.40	\$ 26.16	\$ 29.93	\$ 33.70

SUPPLEMENTAL BENEFITS per hour:

All terms \$ 16.28

11-279.1B/HH

## Electrician

11/01/2020

**JOB DESCRIPTION** Electrician

**DISTRICT** 9

## ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond, Westchester

## WAGES

Per hour:	07/01/2020	03/10/2021
Service Technician	\$ 33.90	\$34.40

Service and Maintenance on Alarm and Security Systems.

Maintenance, repair and /or replacement of defective (or damaged) equipment on, but not limited to, Burglar - Fire - Security - CCTV - Card Access - Life Safety Systems and associated devices. (Whether by service contract of T&M by customer request.)

## SUPPLEMENTAL BENEFITS

Per hour:		
Journeyworker:	\$ 18.43	\$ 19.32

## OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

## HOLIDAY

Paid:	See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE
Overtime:	See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

9-3H

## Electrician

11/01/2020

## JOB DESCRIPTION Electrician

DISTRICT 8

## ENTIRE COUNTIES

Westchester

## WAGES

Per hour:	07/01/2020
Electrician/A-Technician	\$ 52.75
Teledata	\$ 52.75

Note: On a job where employees are required to work on bridges over navigable waters, transmission towers, light poles, bosun chairs, swinging scaffolds , etc. 40 feet or more above the water or ground or under compressed air, or tunnel projects under construction or where assisted breathing apparatus is required, they will be paid at the rate of time and one-half for such work except on normal pole line or building construction work.

## SUPPLEMENTAL BENEFITS

Per hour:	07/01/2020
Journeyworker	\$ 51.80

## OVERTIME PAY

See (A, G, \*J, P) on OVERTIME PAGE

\*NOTE: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

## HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

## REGISTERED APPRENTICES

(1) year terms at the following wage rates:

	07/01/2020
1st term	\$ 13.00
2nd term	15.00
3rd term	17.00
4th term	19.00
MIJ 1-12 months	23.00
MIJ 13-18 months	26.50

Supplemental Benefits per hour:

	07/01/2020
1st term	\$ 9.49
2nd term	12.39
3rd term	13.72
4th term	15.05

MIJ 1-12 months	12.08
MIJ 13-18 months	13.38

8-3/W

<b>Electrician</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Electrician

**DISTRICT 8**

**ENTIRE COUNTIES**

Westchester

**WAGES**

07/01/2020

Electrician	\$ 26.50
H - Telephone	\$ 26.50

Electrical and Teledata work of limited scope, consisting of repairs and /or replacement of defective electrical and teledata equipment.  
- Includes all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls and washing and cleaning of foregoing fixtures.  
See Electrician/A Technician classification for all new installations of wiring, conduit, junction boxes and light fixtures.

**SUPPLEMENTAL BENEFITS**

07/01/2020

Electrician &	
H - Telephone	\$ 13.38

**OVERTIME PAY**

See (B, G, \*J, P) on OVERTIME PAGE

\*Note: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

**HOLIDAY**

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

8-3m

<b>Elevator Constructor</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Elevator Constructor

**DISTRICT 4**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

**PARTIAL COUNTIES**

Rockland: Entire County except for the Township of Stony Point

Westchester: Entire County except for the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

**WAGES**

Per hour:

07/01/2019 03/17/2021

Elevator Constructor	\$ 69.56	\$ 72.29
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Modernization & Service/Repair	\$ 54.56	\$ 56.77
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**SUPPLEMENTAL BENEFITS**

Per Hour:

Elevator Constructor	\$ 41.92	\$ 42.92
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Modernization & Service/Repairs	\$ 40.86	\$ 41.82
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**OVERTIME PAY**

Constructor See ( D, M, T ) on OVERTIME PAGE.

Modern/Service See ( B, F, S ) on OVERTIME PAGE.

**HOLIDAY**

Paid:	See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

WAGES PER HOUR:

\*Note: 1st Term is based on Average wage of Constructor & Modernization.  
Terms 2 thru 4 Based on Journeymans wage of classification Working in.

**1 YEAR TERMS:**

1st Term*	2nd Term	3rd Term	4th Term
50%	55%	65%	75%

**SUPPLEMENTAL BENEFITS**

**Elevator Constructor**

1st Term	\$ 33.38	\$ 34.05
2nd Term	34.20	34.91
3rd Term	35.55	36.30
4th Term	36.89	37.70

**Modernization &  
Service/Repair**

1st Term	\$ 33.33	\$ 34.00
2nd Term	33.82	34.50
3rd Term	35.09	35.83
4th Term	36.36	37.15

4-1

**Elevator Constructor**

**11/01/2020**

**JOB DESCRIPTION** Elevator Constructor

**DISTRICT 1**

**ENTIRE COUNTIES**

Columbia, Dutchess, Greene, Orange, Putnam, Sullivan, Ulster

**PARTIAL COUNTIES**

Delaware: Towns of Andes, Bovina, Colchester, Davenport, Delhi, Harpersfield, Hemdon, Kortright, Meredith, Middletown, Roxbury, Hancock & Stamford

Rockland: Only the Township of Stony Point.

Westchester: Only the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

**WAGES**

Per Hour	07/01/2020	01/01/2021
Mechanic	\$ 60.49	\$62.51
Helper	70% of Mechanic Wage Rate	70% of Mechanic Wage Rate

Four (4), ten (10) hour days may be worked for New Construction and Modernization Work at straight time during a week, Monday thru Thursday or Tuesday thru Friday.

\*\*\*Four (4), ten (10) hour days are not permitted for Contract Work/Repair Work

NOTE - In order to use the '4 Day/10 Hour Work Schedule' as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule', form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

**SUPPLEMENTAL BENEFITS**

Per hour	07/01/2020	01/01/2021
Journeyman/Helper	\$ 34.765*	\$ 34.825*

(\*)Plus 6% of regular hourly if less than 5 years of service. Plus 8% of regular hourly rate if more than 5 years of service.

**OVERTIME PAY**

See (D, O) on OVERTIME PAGE

**HOLIDAY**

Paid: See (5, 6, 15, 16) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE

Note: When a paid holiday falls on Saturday, it shall be observed on Friday. When a paid holiday falls on Sunday, it shall be observed on Monday.

**REGISTERED APPRENTICES**

Wages per hour:

0-6 mo*	6-12 mo	2nd yr	3rd yr	4th yr
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50 %      55 %      65 %      70 %      80 %

(\*)Plus 6% of the hourly rate, no additional supplemental benefits.

Supplemental Benefits per hour worked:

Same as Journeyperson/Helper

1-138

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<b>Glazier</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Glazier

**DISTRICT 8**

**ENTIRE COUNTIES**

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

**WAGES**

Per hour:	7/01/2020	5/31/2021
		Additional
Glazier	\$ 57.55	\$ 2.00
*Scaffolding	58.55	
Glass Tinting & Window Film	29.17	
**Repair & Maintenance	29.17	

\*Scaffolding includes swing scaffold, mechanical equipment, scissor jacks, man lifts, booms & buckets 24' or more, but not pipe scaffolding.

\*\*Repair & Maintenance- All repair & maintenance work on a particular building, whenever performed, where the total cumulative contract value is under \$148,837. All Glass tinting, window film, regardless of material or intended use, and all affixing of decals to windows or glass.

**SUPPLEMENTAL BENEFITS**

Per hour:	7/01/2020
Journeyworker	\$ 34.59
Glass tinting & Window Film	20.29
Repair & Maintenance	20.29

**OVERTIME PAY**

See (B,H,V) on OVERTIME PAGE.

For 'Repair & Maintenance' and 'Glass Tinting & Window Film' see (B, B2, I, S) on overtime page.

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (4, 6, 16, 25) on HOLIDAY PAGE  
For 'Repair & Maintenance' and 'Glass Tinting & Window Film' Only  
Paid: See(5, 6, 16, 25)  
Overtime: See(5, 6, 16, 25)

**REGISTERED APPRENTICES**

Wage per hour:

(1) year terms at the following wage rates:

	7/01/2020
1st term	\$ 20.14
2nd term	28.21
3rd term	34.10
4th term	45.80

Supplemental Benefits:

(Per hour)	
1st term	\$ 16.16
2nd term	22.76
3rd term	25.16
4th term	29.73

8-1087 (DC9 NYC)

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<b>Insulator - Heat &amp; Frost</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Insulator - Heat & Frost

**DISTRICT 8**



## ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Westchester

## WAGES

Per hour:	07/01/2020	05/31/2021
Insulator	\$ 55.00	\$ 2.00
Discomfort & Additional Training**	57.96	
Fire Stop Work*	29.44	

\* Applies on all exclusive Fire Stop Work (When contract is for Fire Stop work only). No apprentices on these contracts only.

\*\*Applies to work requiring: garb or equipment worn against the body not customarily worn by insulators; psychological evaluation; special training, including but not limited to "Yellow Badge" radiation training

Note: Additional \$0.50 per hour for work 30 feet or more above floor or ground level.

## SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker	\$ 34.35
Discomfort & Additional Training	36.30
Fire Stop Work: Journeyworker	17.52

## OVERTIME PAY

See (B, E, E2, Q, \*T) on OVERTIME PAGE

## HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Note: Last working day preceding Christmas and New Years day, workers shall work no later than 12:00 noon and shall receive 8 hrs pay.

Overtime: See ( 2\*, 4, 6, 16, 25 ) on HOLIDAY PAGE.

\*Note: Labor Day triple time if worked.

## REGISTERED APPRENTICES

(1) year terms:

Insulator Apprentices:			
1st	2nd	3rd	4th
\$ 29.44	\$ 34.55	\$ 39.66	\$ 44.78

Discomfort & Additional Training Apprentices:			
1st	2nd	3rd	4th
\$ 30.99	\$ 36.41	\$ 41.83	\$ 47.26

Supplemental Benefits paid per hour:

Insulator Apprentices:	
1st term	\$ 17.52
2nd term	20.89
3rd term	24.25
4th term	27.61

Discomfort & Additional Training Apprentices:	
1st term	\$ 18.50
2nd term	22.06
3rd term	25.62
4th term	29.18

8-91

## ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

## WAGES

Per Hour:	07/01/2020	01/01/2021 Additional
Ironworker Rigger	\$ 67.13	\$ 1.36

Ironworker Stone Derrickman	\$ 67.13
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## SUPPLEMENTAL BENEFITS

Per hour:	\$ 40.94
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## OVERTIME PAY

See (B, D1, \*E, Q, \*\*V) on OVERTIME PAGE

\*Time and one-half shall be paid for all work on Saturday up to eight (8) hours and double time shall be paid for all work thereafter.

\*\* Benefits same premium as wages on Holidays only

## HOLIDAY

Paid:	See (18) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 25) on HOLIDAY PAGE

\*Work stops at schedule lunch break with full day's pay.

## REGISTERED APPRENTICES

Wage per hour:

1/2 year terms at the following hourly wage rate:

	1st	2nd	3rd	4th
07/01/2020	\$33.12	\$47.19	\$52.50	\$57.82

Supplemental benefits:

Per hour:	\$20.93	\$31.23	\$31.23	\$31.23
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9-197D/R

## Ironworker

11/01/2020

## JOB DESCRIPTION Ironworker

DISTRICT 4

## ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

## WAGES

Per Hour:	07/01/2020	01/01/2021 Additional
Ornamental	\$ 45.65	\$ 1.25
Chain Link Fence	45.65	
Guide Rail	45.65	

## SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker:	\$ 58.05

## OVERTIME PAY

See (B, B1, Q, V) on OVERTIME PAGE

## HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 25) on HOLIDAY PAGE

## REGISTERED APPRENTICES

Apprentices hired before 8/31/2018:

(1/2) year terms at the following percentage of Journeyman's wage.

5th Term	80%
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Supplemental Benefits per hour:	
5th Term	52.38

Apprentices Hired after 9/1/18:

1 year terms	
1st Term	\$ 21.13
2nd Term	24.77
3rd Term	36.32
4th Term	TBD

Supplemental Benefits per hour:

1st Term	\$ 17.61
2nd Term	18.86
3rd Term	52.58
4th Term	TBD

4-580-Or

**Ironworker**

**11/01/2020**

**JOB DESCRIPTION** Ironworker

**DISTRICT 4**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

**WAGES**

PER HOUR:

07/01/2020

01/01/2021

Ironworker:

Structural \$ 52.70  
Bridges  
Machinery

Additional

\$1.75/Hr.

**SUPPLEMENTAL BENEFITS**

PER HOUR:

Journeyman \$ 81.35

**OVERTIME PAY**

See (B, B1, Q) on OVERTIME PAGE

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 18, 19) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

WAGES PER HOUR:

6 month terms at the following rate:

1st	\$27.45
2nd	\$28.05
3rd - 6th	\$28.66

Supplemental Benefits

PER HOUR:

All Terms \$56.15

4-40/361-Str

**Ironworker**

**11/01/2020**

**JOB DESCRIPTION** Ironworker

**DISTRICT 4**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

**PARTIAL COUNTIES**

Rockland: Southern section - south of Convent Road and east of Blue Hills Road.

**WAGES**

Per hour: 07/01/2020

Reinforcing &  
Metal Lathing \$ 56.25

"Base" Wage \$ 54.70  
plus \$ 1.55

"Base" Wage is used to calculate overtime hours only.

**SUPPLEMENTAL BENEFITS**

Per hour:

Reinforcing & \$ 38.30

Metal Lathing

**OVERTIME PAY**

See (B, E, Q, \*X) on OVERTIME PAGE

\*Only \$22.00 per Hour for non worked hours

Supplemental Benefit Premiums for Overtime Hours worked:

Time & One Half	\$ 45.08
Double Time	\$ 51.33

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 13, 18, 19, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

(1) year terms at the following wage rates:

Wages Per Hour:

1st term	2nd term	3rd term	4th Term
\$ 22.55	\$ 28.38	\$ 34.68	\$ 37.18

**SUPPLEMENTAL BENEFITS**

Per Hour:

1st term	2nd term	3rd term	4th Term
\$ 18.17	\$ 21.34	\$ 22.00	\$ 20.50

4-46Reinf

**Laborer - Building**

**11/01/2020**

**JOB DESCRIPTION** Laborer - Building

**DISTRICT 8**

**ENTIRE COUNTIES**

Putnam, Westchester

**WAGES**

07/01/2020

Laborer	\$ 35.30 plus \$4.60**
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Laborer - Asbestos & Hazardous Materials Removal	\$ 41.55*
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\* Abatement/Removal of:

- Lead based or lead containing paint on materials to be repainted is classified as Painter.
- Asbestos containing roofs and roofing material is classified as Roofer.

\*\* This portion is not subject to overtime premium.

NOTE: Upgrade/Material condition work plan for work performed during non-outage under a wage formula of 90% wage/100% fringe benefits at nuclear power plants.

**SUPPLEMENTAL BENEFITS**

Per hour: 07/01/2020

Journeyworker	\$ 26.40
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**OVERTIME PAY**

See (B, E, E2, Q, \*V) on OVERTIME PAGE

\*Note: For Sundays and Holidays worked benefits are at the same premium as wages.

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

LABORER ONLY

Hourly terms at the following wage:

Level A	Level B	Level C	Level D	Level E
0-1000	1001-2000	2001-3000	3001-4000	4001+
\$ 23.90	\$ 27.50	\$ 31.50	\$ 38.00	\$ 39.80

Supplemental Benefits per hour:

Apprentices

Level A	\$ 12.35
Level B	15.20
Level C	17.80
Level D	18.20
Level E	26.40

8-235/B

**Laborer - Heavy&Highway**

**11/01/2020**

**JOB DESCRIPTION** Laborer - Heavy&Highway

**DISTRICT** 8

**ENTIRE COUNTIES**

Putnam, Westchester

**WAGES**

**\*\*PUTNAM: APPLIES TO ALL HEAVY & HIGHWAY WORK EXCLUDING HIGHWAYS, STREETS, AND BRIDGES\*\***

GROUP I: Blaster and Quarry Master

GROUP II: Burner, Drillers(jumbo, joy, wagon, air track, hydraulic), Drill Operator, Self Contained Rotary Drill, Curbs/ Asphalt Screedman/Raker, Bar Person.

GROUP III: Pavement Breakers, Jeep Operator, Jack Hammer, Pneumatic Tools (all), Gas Driller, Guniting, Railroad Spike Puller, Pipelayer, Chain Saw, Deck winches on scows, Power Buggy Operator, Power Wheelbarrow Operator, Bar Person Helper.

GROUP IV: Concrete Laborers, Asph. Worker, Rock Scaler, Vibrator Oper., Bit Grinder, Air Tamper, Pumps, Epoxy (adhesives, fillers and troweled on), Barco Rammer, Concrete Grinder, Crack Router Operator, Guide Rail-digging holes and placing concrete and demolition when not to be replaced, distribution of materials and tightening of bolts.

GROUP V: Drillers Helpers, Common Laborer, Mason Tenders, Signal Person, Pit Person, Truck Spotter, Powder Person, Landscape/Nursery Person, Dump Person, Temp. Heat.

GROUP VIA: Asbestos/Toxic Waste Laborer-All removal (Roads, Tunnels, Landfills, etc.) Confined space laborer

Wages:(per hour) 07/01/2020

GROUP I	\$44.45*
GROUP II	43.10*
GROUP III	42.70*
GROUP IV	42.35*
GROUP V	42.00*
GROUP VIA	44.00*
Operator Qualified	
Gas Mechanic	54.45*
Flagperson	35.65*

\*NOTE: To calculate overtime premiums, deduct \$0.10 from above wages

SHIFT WORK: A shift premium will be paid on Public Work contracts for off-shift or irregular shift work when mandated by the NYS D.O.T. or other Governmental Agency contracts. Employees shall receive an additional 15% per hour above current rate for all regular and irregular shift work. Premium pay shall be calculated using the 15% per hour differential as base rate.

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyworker:

First 40 Hours	
Per Hour	\$24.35
Over 40 Hours	
Per Hour	18.10

**OVERTIME PAY**

See (B, E, P, R, S) on OVERTIME PAGE

**HOLIDAY**

Paid: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE  
Overtime: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

NOTE: For Holiday Overtime: 5, 6 - Code 'S' applies  
For Holiday Overtime: 8, 9, 15, 25 - Code 'R' applies

## REGISTERED APPRENTICES

	1st term 1-1000hrs	2nd term 1001-2000hrs	3rd term 2001-3000hrs	4th term 3001-4000hrs
07/01/2020	\$ 23.90	\$ 28.20	\$ 32.50	\$ 36.70

### Supplemental Benefits per hour:

1st term	\$ 3.85 - After 40 hours: \$ 3.60
2nd term	\$ 3.95 - After 40 hours: \$ 3.60
3rd term	\$ 4.45 - After 40 hours: \$ 4.00
4th term	\$ 5.00 - After 40 hours: \$ 4.50

8-60H/H

## Laborer - Tunnel

11/01/2020

### JOB DESCRIPTION Laborer - Tunnel

DISTRICT 11

### ENTIRE COUNTIES

Columbia, Dutchess, Greene, Orange, Otsego, Putnam, Rockland, Sullivan, Ulster, Westchester

### PARTIAL COUNTIES

Chenango: Townships of Columbus, Sherburne and New Berlin.

Delaware: Townships of Andes, Bovina, Middletown, Roxbury, Franklin, Hamden, Stamford, Delhi, Kortright, Harpersfield, Merideth and Davenport.

### WAGES

Class 1: All support laborers/sandhogs working above the shaft or tunnel.

Class 2: All laborers/sandhogs working in the shaft or tunnel.

Class 4: Safety Miners

Class 5: Site work related to Shaft/Tunnel

WAGES: (per hour)

	07/01/2020	07/01/2021	07/01/2022
Class 1	\$ 50.45	\$ 51.95	\$ 53.45
Class 2	52.60	54.10	55.60
Class 4	59.00	60.50	62.00
Class 5	42.25	43.50	44.80

Toxic and hazardous waste, lead abatement and asbestos abatement work will be paid an additional \$ 3.00 an hour.

SHIFT DIFFERENTIAL...On all Government mandated irregular shift work:

- Employee shall be paid at time and one half the regular rate Monday through Friday.
- Saturday shall be paid at 1.65 times the regular rate.
- Sunday shall be paid at 2.15 times the regular rate.

### SUPPLEMENTAL BENEFITS

Per hour:

Benefit 1	\$ 32.15	\$ 33.25	\$ 34.45
Benefit 2	48.15	49.80	51.60
Benefit 3	64.15	66.35	68.75

Benefit 1 applies to straight time hours, paid holidays not worked.

Benefit 2 applies to over 8 hours in a day (M-F), irregular shift work hours worked, and Saturday hours worked.

Benefit 3 applies to Sunday and Holiday hours worked.

### OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE

### HOLIDAY

Paid: See (5, 6, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 16, 25) on HOLIDAY PAGE

When a recognized Holidays falls on Saturday or Sunday, holidays falling on Saturday shall be recognized or observed on Friday and holidays falling on Sunday shall be recognized or observed on Monday. Employees ordered to work on the Saturday or Sunday of the holiday or on the recognized or the observed Friday or Monday for those holidays falling on Saturday or Sunday shall receive double time the established rate and benefits for the holiday.

## REGISTERED APPRENTICES

FOR APPRENTICE RATES, refer to the appropriate Laborer Heavy & Highway wage rate contained in the wage schedule for the County and location where the work is to be performed.

11-17/60/235/754Tun

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**Lineman Electrician****11/01/2020**

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**JOB DESCRIPTION** Lineman Electrician**DISTRICT** 6**ENTIRE COUNTIES**

Westchester

**WAGES**

Below rates apply to electrical overhead and underground distribution and maintenance work and overhead and underground transmission line work, electrical substations, switching structures, continuous pipe-type underground fluid or gas filled transmission conduit and cable installations, maintenance jobs or projects, railroad catenary installations and maintenance, third rail installations, the bonding of rails and the installation of fiber optic cable. (Ref #14.04.01)

Includes Teledata Work performed within ten (10) feet of high voltage (600 volts or over) transmission lines.

Per hour: 07/01/2020

Lineman, Tech, Welder	\$ 56.51
Crane, Crawler Backhoe	56.51
Cable Splicer-Pipe Type	62.16
Digging Mach Operator	50.86
Cert. Welder-Pipe Type	59.34
Tractor Trailer Driver	48.03
Groundman, Truck Driver	45.21
Equipment Mechanic	45.21
Flagman	33.91

Additional \$1.00 per hour for entire crew when a helicopter is used.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

**SUPPLEMENTAL BENEFITS**

Per hour worked (but also required on non-worked holidays):

Journeyman	\$ 24.90
	*plus 6.75% of hourly wage

\*The 6.75% is based on the hourly wage paid, straight time or premium time.

**OVERTIME PAY**

See ( B, E, Q, ) on OVERTIME PAGE. \*Note\* Double time for emergency work designated by the Dept of Jurisdiction.

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

**HOLIDAY**

Paid	See ( 5, 6, 8, 13, 25 ) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime	See ( 5, 6, 8, 13, 25 ) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

**REGISTERED APPRENTICES**

WAGES per hour: 1000 hour terms.

07/01/2020

1st term	\$ 33.91
2nd term	36.73
3rd term	39.56
4th term	42.38
5th term	45.21
6th term	48.03
7th term	50.86

SUPPLEMENTAL BENEFITS per hour: Same as Journeyman

6-1249aWest

**Lineman Electrician - Teledata**

**11/01/2020**

**JOB DESCRIPTION** Lineman Electrician - Teledata

**DISTRICT 6**

**ENTIRE COUNTIES**

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

**WAGES**

Per hour:

For outside work, stopping at first point of attachment (demarcation).

	07/01/2020	01/01/2021
Cable Splicer	\$ 33.77	\$ 34.78
Installer, Repairman	\$ 32.05	\$ 33.01
Teledata Lineman	\$ 32.05	\$ 33.01
Tech., Equip. Operator	\$ 32.05	\$ 33.01
Groundman	\$ 16.99	\$ 17.50

NOTE: EXCLUDES Teledata work within ten (10) feet of High Voltage (600 volts and over) transmission lines. For this work please see LINEMAN.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED:

1ST SHIFT	REGULAR RATE
2ND SHIFT	REGULAR RATE PLUS 10%
3RD SHIFT	REGULAR RATE PLUS 15%

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyman	\$ 5.06	\$ 5.06
	*plus 3% of wage paid	*plus 3% of wage paid

\*The 3% is based on the hourly wage paid, straight time rate or premium rate.

**OVERTIME PAY**

See (B, E, Q) on OVERTIME PAGE

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

**Lineman Electrician - Traffic Signal, Lighting**

**11/01/2020**

**JOB DESCRIPTION** Lineman Electrician - Traffic Signal, Lighting

**DISTRICT 6**

**ENTIRE COUNTIES**

Westchester

**WAGES**



Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors which includes, but is not limited to road loop wires; conduit and plastic or other type pipes that carry conductors, flex cables and connectors, and to oversee the encasement or burial of such conduits or pipes.

A Groundman/Groundman Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

A flagger's duties shall consist of traffic control only.  
(Ref #14.01.03)

Per hour: 07/01/2020

Lineman, Technician	\$ 51.61
Crane, Crawler Backhoe	51.61
Certified Welder	54.19
Digging Machine	46.45
Tractor Trailer Driver	43.87
Groundman, Truck Driver	41.29
Equipment Mechanic	41.29
Flagman	30.97

Above rates are applicable for installation, testing, operation, maintenance and repair on all Traffic Control (Signal) and Illumination (Lighting) projects, Traffic Monitoring Systems, and Road Weather Information Systems. Includes digging of holes for poles, anchors, footer foundations for electrical equipment; assembly of all electrical materials or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

#### **SUPPLEMENTAL BENEFITS**

Per hour worked (but also required on non-worked holidays):

Journeyman	\$ 24.90
	*plus 6.75% of hourly wage

\*The 6.75% is based on the hourly wage paid, straight time rate or premium rate.  
Supplements paid at STRAIGHT TIME rate for holidays.

#### **OVERTIME PAY**

See (B, E, Q) on OVERTIME PAGE. \*Note\* Double time for emergency work designated by the Dept. of Jurisdiction.

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

#### **HOLIDAY**

Paid: See ( 5, 6, 8, 13, 25 ) on HOLIDAY PAGE and Governor of NYS Election Day.

Overtime: See ( 5, 6, 8, 13, 25 ) on HOLIDAY PAGE and Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

#### **REGISTERED APPRENTICES**

WAGES per hour: 1000 hour terms.

1st term	\$ 30.97
2nd term	33.55
3rd term	36.13
4th term	38.71
5th term	41.29
6th term	43.87
7th term	46.45

SUPPLEMENTAL BENEFITS per hour: Same as Journeyman

6-1249aWestLT

<b>Mason - Building</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Mason - Building

**DISTRICT 9**

**ENTIRE COUNTIES**

Nassau, Rockland, Suffolk, Westchester

**WAGES**

Per hour:	07/01/2020	12/07/2020
		Additional
Tile Setters	\$ 60.09	\$0.88

**SUPPLEMENTAL BENEFITS**

Per Hour:	\$ 24.81*
	+ \$9.72

\* This portion of benefits subject to same premium rate as shown for overtime wages.

**OVERTIME PAY**

See (B, E, Q, V) on OVERTIME PAGE

Work beyond 10 hours on Saturday shall be paid at double the hourly wage rate.

**HOLIDAY**

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

Wage per hour:

Tile Setters:

(750 hour) term at the following wage rate:

Term:	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	1-750	751-1500	1501-2250	2251-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6501-7000
07/01/2020	\$20.35	\$25.11	\$32.09	\$36.83	\$40.25	\$43.50	\$46.95	\$51.69	\$54.34	\$58.19

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$12.55*	\$12.55*	\$15.06*	\$15.06*	\$16.06*	\$17.56*	\$18.56*	\$18.56*	\$16.56*	\$21.81*
+\$0.66	+\$0.70	+\$0.80	+\$0.85	+\$1.23	+\$1.27	+\$1.62	+\$1.67	+\$5.82	+\$6.31

\* This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52A

<b>Mason - Building</b>	<b>11/01/2020</b>
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**JOB DESCRIPTION** Mason - Building

**DISTRICT 11**

**ENTIRE COUNTIES**

Putnam, Rockland, Westchester

**PARTIAL COUNTIES**

Orange: Only the Township of Tuxedo.

**WAGES**

Per hour:

07/01/2020

Bricklayer	\$ 42.09
Cement Mason	42.09
Plasterer/Stone Mason	42.09
Pointer/Caulker	42.09

Additional \$1.00 per hour for power saw work  
Additional \$0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular work day is mandated or required by state, federal, county, local or other governmental agency contracts, the following premiums apply:

- Irregular work day requires 15% premium
- Second shift an additional 15% of wage plus benefits to be paid
- Third shift an additional 25% of wage plus benefits to be paid

#### SUPPLEMENTAL BENEFITS

Per hour:

Journeyman	\$ 35.00
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#### OVERTIME PAY

OVERTIME:

Cement Mason	See ( B, E, Q, W ) on OVERTIME PAGE.
All Others	See ( B, E, Q ) on OVERTIME PAGE.

#### HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

#### REGISTERED APPRENTICES

Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5wp-b

#### Mason - Building

11/01/2020

**JOB DESCRIPTION** Mason - Building

**DISTRICT** 9

#### ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

#### WAGES

Building:

	07/01/2020	01/01/2021
Wages per hour:		Additional \$0.95

Mosaic & Terrazzo Mechanic	\$57.42
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Mosaic & Terrazzo Finisher	\$55.82
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#### SUPPLEMENTAL BENEFITS

Per hour:

Mosaic & Terrazzo Mechanic	\$ 25.61* + \$11.47
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Mosaic & Terrazzo Finisher	\$ 25.61*
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+ \$11.45

\*This portion of benefits subject to same premium rate as shown for overtime wages.

### OVERTIME PAY

See (A, E, Q) on OVERTIME PAGE

Deduct \$6.60 from hourly wages before calculating overtime.

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

Easter Sunday is an observed holiday. Holidays falling on a Saturday will be observed on that Saturday. Holidays falling on a Sunday will be celebrated on the Monday.

### REGISTERED APPRENTICES

Wages per hour:

(750 Hour) terms at the following wage rate.

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2020	\$25.40	\$27.94	\$30.49	\$33.03	\$35.57	\$38.11	\$43.20	\$48.28

Supplemental benefits per hour:

07/01/2020	\$ 12.81*	\$ 14.09*	\$ 15.37*	\$ 16.65*	\$ 17.93*	\$ 19.21*	\$ 21.77*	\$ 24.33*
	+\$9.04	+\$9.94	+\$10.84	+\$11.75	+\$12.65	+\$13.55	+\$15.36	+\$17.16

Apprentices hired after 07/01/2017:

Wages Per hour:

	1st 0- 1500	2nd 1501- 3000	3rd 3001- 3750	4th 3751- 4500	5th 4501- 5250	6th 5251- 6000
07/01/2020	\$22.20	\$22.88	\$30.49	\$35.57	\$40.65	\$45.73

Supplemental Benefits per hour:

	1st	2nd	3rd	4th	5th	6th
07/01/2020	\$4.55*	\$11.52*	\$15.37*	\$17.93*	\$20.49*	\$23.05*
	+\$6.32	+\$8.13	+\$10.84	+\$12.65	+\$14.46	+\$16.22

\*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/3

### Mason - Building

11/01/2020

**JOB DESCRIPTION** Mason - Building

**DISTRICT** 9

### ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

### WAGES

Per hour: 07/01/2020 01/01/2021

Building-Marble Restoration: Additional \$1.10

Marble, Stone & Terrazzo Polisher, etc \$ 44.66

### SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker:

Building-Marble Restoration:

Marble, Stone & Polisher \$ 28.41

### OVERTIME PAY

See (B, \*E, Q, V) on OVERTIME PAGE

\*ON SATURDAYS, 8TH HOUR AND SUCCESSIVE HOURS PAID AT DOUBLE HOURLY RATE.

# **HOLIDAY**

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE  
1ST TERM APPRENTICE GETS PAID FOR ALL OBSERVED HOLIDAYS.

# **REGISTERED APPRENTICES**

WAGES per hour:

900 hour term at the following wage:

	1st 1- 900	2nd 901- 1800	3rd 1801- 2700	4th 2701
07/01/2020	\$31.19	\$35.68	\$40.16	\$44.66

Supplemental Benefits Per Hour:

07/01/2020	\$ 25.78	\$ 26.66	\$ 27.54	\$ 28.41	9-7/24-MP
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# **Mason - Building 11/01/2020**

**JOB DESCRIPTION** Mason - Building

**DISTRICT** 9

# **ENTIRE COUNTIES**

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

# **WAGES**

Wages:	07/01/2020	01/14/2021
		Additional
Marble Cutters & Setters	\$ 60.35	\$0.95

# **SUPPLEMENTAL BENEFITS**

Per Hour:

Journeyworker	\$ 37.24
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# **OVERTIME PAY**

See (B, E, Q, V) on OVERTIME PAGE

# **HOLIDAY**

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

# **REGISTERED APPRENTICES**

Wage Per Hour:

750 hour terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1- 750	751- 1500	1501- 2250	2251- 3000	3001- 3750	3751- 4500	4501- 5250	5251- 6000	6001- 6751	6751- 7500
07/01/2020									
\$24.15	\$27.15	\$30.16	\$33.19	\$36.20	\$39.20	\$42.15	\$45.26	\$51.28	\$57.34

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$20.14	\$21.58	\$23.02	\$24.42	\$25.85	\$27.29	\$28.72	\$30.12	\$32.98	\$35.81

9-7/4

# **Mason - Building 11/01/2020**

**JOB DESCRIPTION** Mason - Building

**DISTRICT** 9

# **ENTIRE COUNTIES**

Nassau, Rockland, Suffolk, Westchester

## WAGES

Per hour:	07/01/2020	12/07/2020
		Additional
Tile Finisher	\$ 46.21	\$0.73

## SUPPLEMENTAL BENEFITS

Per Hour:	\$ 21.56*
	+ \$9.65

\*This portion of benefits subject to same premium rate as shown for overtime wages

## OVERTIME PAY

See (B, E, Q, \*V) on OVERTIME PAGE

Work beyond 10 hours on a Saturday shall be paid at double the hourly wage rate.

## HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88A-tf

## Mason - Building

11/01/2020

## JOB DESCRIPTION Mason - Building

DISTRICT 9

## ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

## WAGES

Per hour:	07/01/2020	01/01/2021
Marble, Stone, etc.		Additional
Maintenance Finishers:	\$ 25.53	\$0.68

Note 1: An additional \$2.00 per hour  
for time spent grinding floor using  
"60 grit" and below.

Note 2: Flaming equipment operator  
shall be paid an additional \$25.00 per day.

## SUPPLEMENTAL BENEFITS

Per Hour:	
Marble, Stone, etc	
Maintenance Finishers:	\$ 13.85

## OVERTIME PAY

See (B, \*E, Q, V) on OVERTIME PAGE

\*Double hourly rate after 8 hours on Saturday

## HOLIDAY

Paid:	See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

1st term apprentice gets paid for all observed holidays.

## REGISTERED APPRENTICES

WAGES per hour:	07/01/2020
0-750	\$17.87
751-1500	\$18.89
1501-2250	\$19.92
2251-3000	\$20.93
3001-3750	\$22.47
3751-4500	\$24.51
4501+	\$25.53

Supplemental Benefits:  
Per hour:

0-750	\$ 13.73
751-1500	\$ 13.75
1501-2250	\$ 13.76
2251-3000	\$ 13.78

3001-3750	\$ 13.80
3751-4500	\$ 13.83
4501+	\$ 13.85

9-7/24M-MF

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**Mason - Building / Heavy&Highway****11/01/2020**

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**JOB DESCRIPTION** Mason - Building / Heavy&Highway**DISTRICT** 9**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

**WAGES**

Per hour:	07/01/2020	01/14/2021
		Additional
Marble-Finisher	\$ 47.92	\$0.61

**SUPPLEMENTAL BENEFITS**Journeyworker:  
per hour

Marble- Finisher \$ 34.99

**OVERTIME PAY**

See (B, E, Q, V) on OVERTIME PAGE

**HOLIDAY**

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

\* Work beyond 8 hours on a Saturday shall be paid at double the rate.

\*\* When an observed holiday falls on a Sunday, it will be observed the next day.

9-7/20-MF

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**Mason - Heavy&Highway****11/01/2020**

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**JOB DESCRIPTION** Mason - Heavy&Highway**DISTRICT** 11**ENTIRE COUNTIES**

Putnam, Rockland, Westchester

**PARTIAL COUNTIES**

Orange: Only the Township of Tuxedo.

**WAGES**

Per hour:	07/01/2020
Bricklayer	\$ 42.60
Cement Mason	42.60
Marble/Stone Mason	42.60
Plasterer	42.60
Pointer/Caulker	42.60

Additional \$1.00 per hour for power saw work

Additional \$0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular work day is mandated or required by state, federal, county, local or other governmental contracts, the following rates apply:

Irregular work day requires 15% premium

Second shift an additional 15% of wage plus benefits to be paid

Third shift an additional 25% of wage plus benefits to be paid

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyman \$ 34.99

**OVERTIME PAY**

Cement Mason See ( B, E, Q, W, X )

All Others See ( B, E, Q, X )

**HOLIDAY**

Paid: See (5, 6, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 25) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

### REGISTERED APPRENTICES

Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5WP-H/H

### Operating Engineer - Building

11/01/2020

**JOB DESCRIPTION** Operating Engineer - Building

**DISTRICT** 9

#### ENTIRE COUNTIES

Bronx, Kings, New York, Putnam, Queens, Richmond, Westchester

#### PARTIAL COUNTIES

Dutchess: that part of Dutchess County lying south of the North City Line of the City of Poughkeepsie.

#### WAGES

NOTE:Construction surveying

Party chief--One who directs a survey party

Instrument Man--One who runs the instrument and assists Party Chief.

Rodman--One who holds the rod and assists the Survey Crew

Wages:(Per Hour) 07/01/2020

Building Construction:

Party Chief	\$ 74.75
Instrument Man	\$ 59.53
Rodman	\$ 40.79

Steel Erection:

Party Chief	\$ 78.44
Instrument Man	\$ 62.74
Rodman	\$ 44.39

Heavy Construction-NYC counties only:  
(Foundation, Excavation.)

Party Chief	\$ 83.87
Instrument man	\$ 63.61
Rodman	\$ 54.59

#### SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2020

Building Construction &  
Steel \$ 22.85\* + 6.90

Heavy Construction \$ 23.10\* + 6.90

\* This portion subject to same premium as wages

Non-Worked Holiday Supplemental Benefit:  
\$ 16.45



## OVERTIME PAY

See (A, B, E, Q) on OVERTIME PAGE

Code "A" applies to Building Construction and has double the rate after 7 hours on Saturdays.

Code "B" applies to Heavy Construction and Steel Erection and had double the rate after 8 hours on Saturdays.

## HOLIDAY

Paid: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

9-15Db

## Operating Engineer - Building

11/01/2020

**JOB DESCRIPTION** Operating Engineer - Building

**DISTRICT** 8

## ENTIRE COUNTIES

Putnam, Westchester

## PARTIAL COUNTIES

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

## WAGES

### GROUP I:

Cranes (All Types up to 49 tons), Boom Trucks, Cherry Pickers (All Types), Clamshell Crane, Derrick (Stone and Steel), Dragline, Franki Pile Rig or similar, High Lift (Lull or similar) with crane attachment and winch used for hoisting or lifting, Hydraulic Cranes, Pile Drivers, Potain and similar.

Cranes (All types 50-99 tons), Drill Rig Casa Grande (CAT or similar), Franki Pile Rig or similar, Hydraulic Cranes (All types including Crawler Cranes- No specific boom length).

Cranes (All types 100 tons and over), All Tower Cranes, All Climbing Cranes irrespective of manufacturer and regardless of how the same is rigged, Franki Pile Rig or similar, Conventional Cranes (All types including Crawler Cranes-No specific boom length), Hydraulic Cranes.

GROUP I-A: Barber Green Loader-Euclid Loader, Bulldozer, Carrier-Trailer Horse, Concrete Cleaning Decontamination Machine Operator, Concrete-Portable Hoist, Conway or Similar Mucking Machines, Elevator & Cage, Excavators all types, Front End Loaders, Gradall, Shovel, Backhoe, etc.(Crawler or Truck), Heavy Equipment Robotics Operator/Mechanic, Hoist Engineer-Material, Hoist Portable Mobile Unit, Hoist(Single, Double or Triple Drum), Horizontal Directional Drill Locator, Horizontal Directional Drill Operator and Jersey Spreader, Letourneau or Tournapull(Scrapers over 20 yards Struck), Lift Slab Console, etc., Lull HiLift or Similar, Master Environmental Maintenance Mechanics, Mucking Machines Operator/Mechanic or Similar Type, Overhead Crane, Pavement Breaker(Air Ram), Paver(Concrete), Post Hole Digger, Power House Plant, Road Boring Machine, Road Mix Machine, Ross Carrier and Similar Machines, Rubber tire double end backhoes and similar machines, Scoopmobile Tractor-Shovel Over 1.5 yards, Shovel (Tunnels), Spreader (Asphalt) Telephie(Cableway), Tractor Type Demolition Equipment, Trenching Machines-Vermeer Concrete Saw Trencher and Similar, Ultra High Pressure Waterjet Cutting Tool System, Vacuum Blasting Machine operator/mechanic, Winch Truck A Frame.

GROUP I-B: Compressor (Steel Erection), Mechanic (Outside All Types), Negative Air Machine (Asbestos Removal), Push Button (Buzz Box) Elevator.

GROUP II: Compactor Self-Propelled, Concrete Pump, Crane Operator in Training (Over 100 Tons), Grader, Machines Pulling Sheep's Foot Roller, Roller (4 ton and over), Scrapers (20 yards Struck and Under), Vibratory Rollers, Welder.

GROUP III-A: Asphalt Plant, Concrete Mixing Plants, Forklift (All power sources), Joy Drill or similar, Tractor Drilling Machine, Loader (1 1/2 yards and under), Portable Asphalt Plant, Portable Batch Plant, Portable Crusher, Skid Steer (Bobcat or similar), Stone Crusher, Well Drilling Machine, Well Point System.

GROUP III-B: Compressor Over 125 cu.Feet, Conveyor Belt Machine regardless of size, Compressor Plant, Ladder Hoist, Stud Machine.

GROUP IV-A: Batch Plant, Concrete Breaker, Concrete Spreader, Curb Cutter Machine, Finishing Machine-Concrete, Fine Grading Machine, Hepa Vac Clean Air Machine, Material Hopper(sand, stone, cement), Mulching Grass Spreader, Pump Gypsum etc, Pump-Plaster-Grout-Fireproofing. Roller(Under 4 Ton), Spreading and Fine Grading Machine, Steel Cutting Machine, Siphon Pump, Tar Joint Machine, Television Cameras for Water, Sewer, Gas etc. Turbo Jet Burner or Similar Equipment, Vibrator (1 to 5).

GROUP IV-B: Compressor (all types), Heater (All Types), Fire Watchman, Lighting Unit (Portable & Generator) Pump, Pump Station(Water, Sewer, Portable, Temporary), Welding Machine (Steel Erection & Excavation).

GROUP V: Mechanics Helper, Motorized Roller (walk behind), Stock Attendant, Welder's Helper.

GROUP VI-B: Utility Man, Warehouse Man.

WAGES: (per hour)

07/01/2020

GROUP I	
Cranes- up to 49 tons	\$ 61.70
Cranes- 50 tons to 99 tons	63.86
Cranes- 100 tons and over	72.99
GROUP I-A	53.95
GROUP I-B	49.68
GROUP II	52.03
GROUP III-A	50.11
GROUP III-B	47.67
GROUP IV-A	49.60
GROUP IV-B	41.85
GROUP V	45.17
GROUP VI-A	52.96
GROUP VI-B	
Utility Man	42.83
Warehouse Man	44.92

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects.  
Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour.  
Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour.  
Loader operators over 5 cubic yard capacity additional .50 per hour.  
Shovel operators over 4 cubic yard capacity additional \$1.00 per hour.

**SUPPLEMENTAL BENEFITS**

Per hour:

07/01/2020

Journeyworker	\$ 28.52
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**OVERTIME PAY**

OVERTIME:..... See ( B, E,P,R\*,T\*\*,U\*\*\*,V ) on OVERTIME PAGE.

**HOLIDAY**

Paid:..... See ( 5, 6, 11, 12, 15, 25 ) on HOLIDAY PAGE.

Overtime:..... See ( 5, 6, 11, 12, 15, 25 ) on HOLIDAY PAGE.

\* For Holiday codes 11, 12, 15, 25, code R applies.

\*\* For Holiday code 28, code T applies

\*\*\* For Holiday codes 5 & 6, code U applies

8-137B

**Operating Engineer - Heavy&Highway**

**11/01/2020**

**JOB DESCRIPTION** Operating Engineer - Heavy&Highway

**DISTRICT 8**

**ENTIRE COUNTIES**

Putnam, Westchester

**PARTIAL COUNTIES**

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

**WAGES**

GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane, (Crawler, Truck),  
Dragline, Drill Rig (Casa Grande, Cat, or Similar), Floating Crane (Crane on Barges) under 100 tons, Gin Pole, Hoist Engineer-Concrete (Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger (Truck or Truck Mounted), Boat Captain, Bulldozer-All Sizes, Central Mix Plant Operator, Chipper (all types), Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader (Motor Grader), Elevator & Cage (Materials or Passenger), Excavator (and all attachments), Front End Loaders (1 1/2 yards and over), High Lift Lull and similar, Hoist (Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer (Material), Jack and Bore Machine, Log Skidders, Mill Machines, Mucking Machines, Overhead Crane, Paver (concrete), Post Pounder (of any type), Push Cats, Road Reclaimer, Robot Hammer (Brokk or similar), Robotic Equipment (Scope of Engineer Schedule), Ross Carrier and similar, Scrapers (20 yard struck and over), Side Boom, Slip Form Machine, Spreader (Asphalt), Trenching Machines (Telephies-Vermeer Concrete Saw), Tractor Type Demolition Equipment, Vacuum Truck.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver (Asphalt).

GROUP II-A: Ballast Regulators, Compactor Self Propelled, Fusion Machine, Rail Anchor Machines, Roller (4 ton and over), Scrapers (20 yard struck and under), Vibratory Roller (Riding), Welder.

GROUP II-B: Mechanic (Outside) All Types.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler (High Pressure), Concrete Breaker (Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift (all types), Gas Tapping (Live), Hydroseeder, Loader (1 1/2 yards and under), Locomotive (all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher (Apprentice), Powerhouse Plant, Roller (under 4 ton), Sheer Excavator, Skid Steer/Bobcat, Stone Crusher, Sweeper (with seat), Well Drilling Machine.

GROUP IV: Service Person (Grease Truck).

GROUP IV-B: Conveyor Belt Machine (Truck Mounted), Heater (all types), Lighting Unit (Portable), Maintenance Engineer (For Crane Only), Mechanics Helper, Pump (Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck (Sewer Jet or Similar), Welders Helper, Welding Machine (Steel Erection), Well Point System.

GROUP V: All Tower Cranes-All Climbing Cranes and all cranes of 100-ton capacity or greater (3900 Manitowac or similar) irrespective of manufacturer and regardless of how the same is rigged, Hoist Engineer (Steel), Engineer-Pile Driver, Jersey Spreader, Pavement Breaker/Post Hole Digger.

WAGES: Per hour: 07/01/2020

Group I	\$ 62.38
Group I-A	54.95
Group I-B	57.92
Group II-A	52.61
Group II-B	54.26
Group III	51.68
Group IV-A	46.93
Group IV-B	40.24
Group V-A	
Engineer All Tower, Climbing and	
Cranes of 100 Tons	70.72
Hoist Engineer(Steel)	64.00
Engineer(Pile Driver)	68.27
Jersey Spreader,Pavement Breaker (Air	
Ram)Post Hole Digger	53.83

**SHIFT DIFFERENTIAL:**

A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts  
on all government mandated off-shift work

Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour over the rate listed in the Wage Schedule. Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour over the rate listed in the Wage Schedule. Loader and Excavator Operators: over 5 cubic yards capacity \$0.50 per hour over the rate listed in the Wage Schedule. Shovel Operators: over 4 cubic yards capacity \$1.00 per hour over the rate listed in the Wage Schedule.

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday; Friday may be used as a make-up day.

NOTE - In order to use the 4 Day/10 Hour Work scheduleRegistration for Use of 4 Day/10 Hour Work Schedule,form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyworker:	07/01/2020
	\$ 30.50 up to 40 Hours
	After 40 hours \$ 21.35* PLUS \$ 1.15 on all hours worked

\*This amount is subject to premium

**OVERTIME PAY**

See (B, E, E2, P, \*R, \*\*U) on OVERTIME PAGE

### HOLIDAY

Paid:..... See ( 5, 6, 8, 9, 15, 25 ) on HOLIDAY PAGE

Overtime..... See ( 5, 6, 8, 9, 15, 25 ) on OVERTIME PAGE

\* For Holiday codes 8,9,15,25 code R applies

\*\* For Holiday Codes 5 & 6 code U applies

Note: If employees are required to work on Easter Sunday they shall be paid at the rate of triple time.

### REGISTERED APPRENTICES

(1)year terms at the following rate.

07/01/2020

1st term	\$ 27.48
2nd term	32.97
3rd term	38.47
4th term	43.96

Supplemental Benefits per hour:

\$ 22.50

8-137HH

### Operating Engineer - Heavy&Highway

11/01/2020

**JOB DESCRIPTION** Operating Engineer - Heavy&Highway

**DISTRICT 9**

### ENTIRE COUNTIES

Putnam, Westchester

### PARTIAL COUNTIES

Dutchess: South of the North city line of Poughkeepsie

### WAGES

Party Chief - One who directs a survey party

Instrument Man - One who runs the instrument and assists Party Chief

Rodman - One who holds the rod and in general, assists the Survey Crew

Catogories cover GPS & Underground Surveying

Per Hour: 07/01/2020

Party Chief \$ 81.06

Instrument Man 61.32

Rodman 52.53

### SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2020

All Catogories

Straight Time: \$ 23.10\* plus \$6.90

Premium:

Time & 1/2 \$ 34.65\* plus \$6.90

Double Time \$ 46.20\* plus \$6.90

Non-Worked Holiday Supplemental Benefits:

\$ 16.45

### OVERTIME PAY

See (B, \*E, Q) on OVERTIME PAGE

\* Doubletime paid on all hours in excess of 8 hours on Saturday

### HOLIDAY

Paid: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

Overtime: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

9-15Dh

### Operating Engineer - Heavy&Highway - Tunnel

11/01/2020

**JOB DESCRIPTION** Operating Engineer - Heavy&Highway - Tunnel

**DISTRICT** 8

**ENTIRE COUNTIES**

Putnam, Westchester

**PARTIAL COUNTIES**

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

**WAGES**

GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane(Crawler,Truck), Dragline, Drill Rig Casa Grande(Cat or Similar), Floating Crane(Crane on Barge-Under 100 Tons), Hoist Engineer(Concrete/Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger(Truck or Truck Mounted), Boat Captain, Bull Dozer-all sizes, Central Mix Plant Operator, Chipper-all types, Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader(Motor Grader), Elevator & Cage(Materials or Passengers), Excavator(and all attachments), Front End Loaders(1 1/2 yards and over), High Lift Lull, Hoist(Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer(Material), Jack and Bore Machine, Log Skidder, Milling Machine, Moveable Concrete Barrier Transfer & Transport Vehicle, Mucking Machines. Overhead Crane, Paver(Concrete), Post Pounder of any type, Push Cats, Road Reclaimer, Robot Hammer(Brokk or similar), Robotic Equipment(Scope of Engineer Schedule), Ross Carrier and similar machines, Scrapers(20 yards struck and over), Side Boom, Slip Form Machine, Spreader(Asphalt), Trenching Machines, Telephies-Vermeer Concrete Saw, Tractor type demolition equipment, Vacuum Truck.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver(Asphalt).

GROUP II-A: Ballast Regulators, Compactor(Self-propelled), Fusion Machine, Rail Anchor Machines, Roller(4 ton and over), Scrapers(20 yard struck and under), Vibratory Roller(riding), Welder.

GROUP II-B: Mechanic(outside)all types.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler(High Pressure), Concrete Breaker(Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift(all types of power), Gas Tapping(Live), Hydroseeder, Loader(1 1/2 yards and under), Locomotive(all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher(Apprentice), Powerhouse Plant, Roller(under 4 ton), Sheer Excavator, Skidsteer/Bobcat, Stone Crusher, Sweeper(with seat), Well Drilling Machine.

GROUP IV-A: Service Person(Grease Truck).

GROUP IV-B: Conveyor Belt Machine(Truck Mounted), Heater(all types), Lighting Unit(Portable), Maintenance Engineer(for Crane only), Mechanics Helper, Pump(Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck(Sewer Jet or similar), Welding Machine(Steel Erection), Welders Helper.

GROUP V-A: Engineer(all Tower Cranes, all Climbing Cranes & all Cranes of 100 ton capacity or greater),Hoist Engineer(Steel-Sub Structure), Engineer-Pile Driver, Jersey-Spreader, Pavement breaker, Post Hole Digger

WAGES: (per hour)

07/01/2020

GROUP I	\$ 62.38
GROUP I-A	54.95
GROUP I-B	57.92
GROUP II-A	52.61
GROUP II-B	54.26
GROUP III	51.68
GROUP IV-A	46.93
GROUP IV-B	40.24
GROUP V-A	
Engineer-Cranes	70.72
Engineer-Pile Driver	68.27
Hoist Engineer	64.00
Jersey Spreader	53.83
Pavement Breaker	53.83
Post Hole Digger	53.83

**SHIFT DIFFERENTIAL:**

A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts  
on all government mandated off-shift work

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects. Operators required to use two buckets pouring concrete on other than road pavement shall receive \$0.50 per hour over scale. Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour. Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour. Operators of shovels with a capacity over (4) cubic yards shall be paid an additional \$1.00 per hour. Operators of loaders with a capacity over (5) cubic yards shall be paid an additional \$0.50 per hour.

### SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker:

07/01/2020

\$ 22.50

+ \$8.00

(Limited to  
first 40 hours)

### OVERTIME PAY

See (D, O, \*U, V) on OVERTIME PAGE

### HOLIDAY

Paid: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

\* Note: For Holiday codes 5 & 6, code U applies.

Note: If employees are required to work on Easter Sunday, they shall be paid at the rate of triple time.

### REGISTERED APPRENTICES

(1)year terms at the following rates:

07/01/2020

1st term \$ 27.48

2nd term 32.97

3rd term 38.47

4th term 43.96

Supplemental Benefits per hour:

07/01/2020

All terms \$ 22.50

8-137Tun

### Operating Engineer - Marine Dredging

11/01/2020

**JOB DESCRIPTION** Operating Engineer - Marine Dredging

**DISTRICT 4**

### ENTIRE COUNTIES

Albany, Bronx, Cayuga, Chautauqua, Clinton, Columbia, Dutchess, Erie, Essex, Franklin, Greene, Jefferson, Kings, Monroe, Nassau, New York, Niagara, Orange, Orleans, Oswego, Putnam, Queens, Rensselaer, Richmond, Rockland, St. Lawrence, Suffolk, Ulster, Washington, Wayne, Westchester

### WAGES

These wages do not apply to Operating Engineers on land based construction projects. For those projects, please see the Operating Engineer Heavy/Highway Rates. The wage rates below for all equipment and operators are only for marine dredging work in navigable waters found in the counties listed above.

Per Hour: 07/01/2020 10/01/2020

CLASS A1 \$ 40.31 \$ 41.42

Deck Captain, Leverman

Mechanical Dredge Operator

Licensed Tug Operator 1000HP or more.

CLASS A2 35.92 36.91

Crane Operator (360 swing)

CLASS B To conform to Operating Engineer  
Dozer, Front Loader Prevailing Wage in locality where work  
Operator on Land is being performed including benefits.

CLASS B1 34.86 35.82

Derrick Operator (180 swing)

Spider/Spill Barge Operator

Operator II, Fill Placer,

Engineer, Chief Mate, Electrician,  
Chief Welder, Maintenance Engineer  
Licensed Boat, Crew Boat Operator

CLASS B2 Certified Welder	32.82	33.72
CLASS C1 Drag Barge Operator, Steward, Mate, Assistant Fill Placer	31.92	32.80
CLASS C2 Boat Operator	30.89	31.74
CLASS D Shoreman, Deckhand, Oiler, Rodman, Scowman, Cook, Messman, Porter/Janitor	25.66	26.37

### SUPPLEMENTAL BENEFITS

Per Hour:

THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B	07/01/2020 \$11.58 plus 7.5% of straight time wage, Overtime hours add \$ 0.63	10/01/2020 \$11.98 plus 8% of straight time wage, Overtime hours add \$ 0.63
All Class C	\$11.28 plus 7.5% of straight time wage, Overtime hours add \$ 0.48	11.68 plus 8% of straight time wage, Overtime hours add \$ 0.48
All Class D	\$10.98 plus 7.5% of straight time wage, Overtime hours add \$ 0.33	11.38 plus 8% of straight time wage, Overtime hours add \$ 0.33

### OVERTIME PAY

See (B2, F, R) on OVERTIME PAGE

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarDredge

## Operating Engineer - Survey Crew - Consulting Engineer 11/01/2020

**JOB DESCRIPTION** Operating Engineer - Survey Crew - Consulting Engineer

**DISTRICT** 9

### ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

### PARTIAL COUNTIES

Dutchess: That part in Dutchess County lying South of the North City line of Poughkeepsie.

### WAGES

Feasibility and preliminary design surveying, any line and grade surveying for inspection or supervision of construction.

Per hour: 07/01/2020  
Survey Classifications

Party Chief	\$ 45.32
Instrument Man	37.85
Rodman	33.14

### SUPPLEMENTAL BENEFITS

Per Hour:

All Crew Members: \$ 19.50

**OVERTIME PAY**

OVERTIME:.... See ( B, E\*, Q, V ) ON OVERTIME PAGE.

\*Doubletime paid on the 9th hour on Saturday.

**HOLIDAY**

Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

9-15dconsult

**Painter**

**11/01/2020**

**JOB DESCRIPTION** Painter

**DISTRICT 8**

**ENTIRE COUNTIES**

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

**WAGES**

Per hour: 07/01/2020

Brush \$ 49.20\*

Abatement/Removal of lead based  
or lead containing paint on  
materials to be repainted. 49.20\*

Spray & Scaffold \$ 52.20\*

Fire Escape 52.20\*

Decorator 52.20\*

Paperhanger/Wall Coverer 51.96\*

\*Subtract \$ 0.10 to calculate premium rate.

**SUPPLEMENTAL BENEFITS**

Per hour: 07/01/2020

Paperhanger \$ 30.70

All others 28.81

Premium 32.10\*\*

\*\*Applies only to "All others" category, not paperhanger journeyworker.

**OVERTIME PAY**

See (A, H) on OVERTIME PAGE

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

One ( 1 ) year terms at the following wage rate.

Per hour: 07/01/2020

Appr 1st term... \$ 19.12\*

Appr 2nd term... 24.52\*

Appr 3rd term... 29.72\*

Appr 4th term... 39.75\*

\*Subtract \$ 0.10 to calculate premium rate.

Supplemental benefits:

Per Hour: 07/01/2020

Appr 1st term... \$ 14.32

Appr 2nd term... 17.78

Appr 3rd term... 20.50

Appr 4th term... 25.89

8-NYDC9-B/S

**Painter**

**11/01/2020**

**JOB DESCRIPTION** Painter

**DISTRICT 8**



## ENTIRE COUNTIES

Putnam, Suffolk, Westchester

## PARTIAL COUNTIES

Nassau: All of Nassau except the areas described below: Atlantic Beach, Ceaderhurst, East Rockaway, Gibson, Hewlett, Hewlett Bay, Hewlett Neck, Hewlett Park, Inwood, Lawrence, Lido Beach, Long Beach, parts of Lynbrook, parts of Oceanside, parts of Valley Stream, and Woodmere. Starting on the South side of Sunrise Hwy in Valley Stream running east to Windsor and Rockaway Ave., Rockville Centre is the boundary line up to Lawson Blvd. turn right going west all the above territory. Starting at Union Turnpike and Lakeville Rd. going north to Northern Blvd. the west side of Lakeville road to Northern blvd. At Northern blvd. going east the district north of Northern blvd. to Port Washington Blvd. West of Port Washington blvd. to St. Francis Hospital then north of first traffic light to Port Washington and Sands Point, Manor HAven, Harbour Acres.

## WAGES

Per hour:	07/01/2020
Drywall Taper	\$ 49.20*

\*Subtract \$ 0.10 to calculate premium rate.

## SUPPLEMENTAL BENEFITS

Per hour:	07/01/2020
Journeyman	\$ 28.81

## OVERTIME PAY

See (A, H) on OVERTIME PAGE

## HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 16, 25) on HOLIDAY PAGE

## REGISTERED APPRENTICES

Wages - Per Hour:	07/01/2020
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1500 hour terms at the following wage rate:

1st term	\$ 19.12*
2nd term	24.52*
3rd term	29.72*
4th term	39.75*

\*Subtract \$ 0.10 to calculate premium rate.

Supplemental Benefits - Per hour:

One year term (1500 hours) at the following dollar amount.

1st year	\$ 14.32
2nd year	17.78
3rd year	20.40
4th year	25.89

8-NYDCT9-DWT

## Painter - Bridge & Structural Steel

11/01/2020

**JOB DESCRIPTION** Painter - Bridge & Structural Steel

**DISTRICT** 8

## ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

## WAGES

Per Hour:

STEEL:

Bridge Painting:	07/01/2020	10/01/2020	10/01/2021
	\$ 50.25	\$ 51.50	\$ 53.00
	+ 7.88*	+ 8.63*	+ 9.63*

ADDITIONAL \$6.00 per hour for POWER TOOL/SPRAY, whether straight time or overtime.

NOTE: All premium wages are to be calculated on base rate per hour only.

\* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

NOTE: Generally, for Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

**SHIFT WORK:**

When directly specified in public agency or authority contract documents for an employer to work a second shift and works the second shift with employees other than from the first shift, all employees who work the second shift will be paid 10% of the base wage shift differential in lieu of overtime for the first eight (8) hours worked after which the employees shall be paid at time and one half of the regular wage rate. When a single irregular work shift is mandated in the job specifications or by the contracting agency, wages shall be paid at time and one half for single shifts between the hours of 3pm-11pm or 11pm-7am.

**SUPPLEMENTAL BENEFITS**

Per Hour:

Journeyworker:	07/01/2020	10/01/2020	10/01/2021
	\$ 10.20	\$ 10.90	\$ 10.90
	+ 29.65*	+ 30.00*	+ 30.60*

\* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

**OVERTIME PAY**

See (B, F, R) on OVERTIME PAGE

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (4, 6) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

Wage - Per hour:

Apprentices: (1) year terms

	07/01/2020	10/01/2020	10/01/2021
1st year	\$ 20.10 + 3.15*	\$ 20.60 + 3.45*	\$ 21.20 + 3.86*
2nd year	\$ 30.15 + 4.73*	\$ 30.90 + 5.18*	\$ 31.80 + 5.78*
3rd year	\$ 40.20 + 6.30*	\$ 41.20 + 6.90*	\$ 42.40 + 7.71*
Supplemental Benefits - Per hour:			
1st year	\$ .25 + 11.86*	\$ .25 + 12.00*	\$ .25 + 12.24*
2nd year	\$ 10.20 + 17.79*	\$ 10.90 + 18.00*	\$ 10.90 + 18.36*
3rd year	\$ 10.20 + 23.72*	\$ 10.90 + 24.00*	\$ 10.90 + 24.48*

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

**Painter - Line Striping**

**11/01/2020**

**JOB DESCRIPTION** Painter - Line Striping

**DISTRICT 8**

**ENTIRE COUNTIES**

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

**WAGES**

Per hour:

Painter (Striping-Highway):	07/01/2020	07/01/2021	07/01/2022
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Striping-Machine Operator*	\$ 30.10	\$ 30.32	\$ 31.53
Linerman Thermoplastic	\$ 36.53	\$ 36.93	\$ 38.34

Note: \* Includes but is not limited to: Positioning of cones and directing of traffic using hand held devices. Excludes the Driver/Operator of equipment used in the maintenance and protection of traffic safety.

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day.

NOTE - In order to use the '4 Day/10 Hour Work Schedule,' as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

#### SUPPLEMENTAL BENEFITS

Per hour paid:	07/01/2020	07/01/2021	07/01/2022
Journeyworker:			
Striping Machine Operator:	\$ 9.16	\$ 10.03	\$ 10.03
Linerman Thermoplastic:	\$ 9.16	\$ 10.03	\$ 10.03

#### OVERTIME PAY

See (B, B2, E2, F, S) on OVERTIME PAGE

#### HOLIDAY

Paid: See (5, 20) on HOLIDAY PAGE  
Overtime: See (5, 20) on HOLIDAY PAGE

#### REGISTERED APPRENTICES

One (1) year terms at the following wage rates:

	07/01/2020	07/01/2021	07/01/2022
1st Term:	\$ 12.04	\$ 12.12	\$ 12.61
2nd Term:	\$ 18.06	\$ 18.19	\$ 19.82
3rd Term:	\$ 24.08	\$ 24.26	\$ 25.22

Supplemental Benefits per hour:

1st term:	\$ 9.16	\$ 10.03	\$ 10.03
2nd Term:	\$ 9.16	\$ 10.03	\$ 10.03
3rd Term:	\$ 9.16	\$ 10.03	\$ 10.03

8-1456-LS

#### Painter - Metal Polisher

11/01/2020

**JOB DESCRIPTION** Painter - Metal Polisher

**DISTRICT 8**

#### ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

#### WAGES

	07/01/2020
Metal Polisher	\$ 36.33
Metal Polisher*	37.43
Metal Polisher**	40.33

\*Note: Applies on New Construction & complete renovation

\*\* Note: Applies when working on scaffolds over 34 feet.

#### SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2020

Journeyworker:	
All classification	\$ 9.94

### OVERTIME PAY

See (B, E, P, T) on OVERTIME PAGE

### HOLIDAY

Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE  
Overtime: See (5, 6, 9, 11, 15, 16, 25, 26) on HOLIDAY PAGE

### REGISTERED APPRENTICES

Wages per hour:

One (1) year term at the following wage rates:

	07/01/2020
1st year	\$ 16.00
2nd year	17.00
3rd year	18.00
1st year*	\$ 16.39
2nd year*	17.44
3rd year*	18.54
1st year**	\$ 18.50
2nd year**	19.50
3rd year**	20.50

\*Note: Applies on New Construction & complete renovation

\*\* Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:

Per hour:

1st year	\$ 6.69
2nd year	6.69
3rd year	6.69

8-8A/28A-MP

### Plumber

11/01/2020

**JOB DESCRIPTION** Plumber

**DISTRICT** 8

### ENTIRE COUNTIES

Putnam, Westchester

### WAGES

Per hour:

	07/01/2020
Plumber and Steamfitter	\$ 57.86

### SHIFT WORK:

When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

### SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 37.56

### OVERTIME PAY

See (B, E, E2, Q, V) on OVERTIME PAGE

OVERTIME:... See on OVERTIME PAGE.

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 16, 25) on HOLIDAY PAGE

### REGISTERED APPRENTICES

(1)year terms at the following wages:

1st Term	\$ 21.44
2nd Term	24.62

3rd Term	28.42
4th Term	40.61
5th Term	43.58

Supplemental Benefits per hour:

1st term	\$ 15.59
2nd term	17.38
3rd term	20.69
4th term	27.20
5th term	28.82

8-21.1-ST

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**Plumber - HVAC / Service**

**11/01/2020**

**JOB DESCRIPTION** Plumber - HVAC / Service

**DISTRICT 8**

**ENTIRE COUNTIES**

Dutchess, Putnam, Westchester

**PARTIAL COUNTIES**

Delaware: Only the townships of Middletown and Roxbury

Ulster: Entire County(including Walkill and Shawangunk Prisons) except for remainder of Town of Shawangunk and Towns of Plattekill, Marlboro, and Wawarsing.

**WAGES**

Per hour: 07/01/2020

HVAC Service \$ 39.68  
+ \$ 4.32\*

\*Note: This portion of wage is not subject to overtime premium.

**SUPPLEMENTAL BENEFITS**

Per hour:  
07/01/2020

Journeyworker HVAC Service

\$ 25.14

**OVERTIME PAY**

See (B, F, R) on OVERTIME PAGE

**HOLIDAY**

Paid: See (5, 6, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

HVAC SERVICE

(1)year terms at the following wages:

07/01/2020				
1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.
\$ 18.05	\$ 21.33	\$ 26.66	\$ 32.76	\$ 35.46
+\$2.37*	+\$2.67*	+\$3.22*	+\$3.84*	+\$4.07*

\*Note: This portion of wage is not subject to overtime premium.

Supplemental Benefits per hour:

Apprentices 07/01/2020

1st term	\$ 19.03
2nd term	20.09
3rd term	21.30
4th term	22.90
5th term	24.07

8-21.1&2-SF/Re/AC

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**Plumber - Jobbing & Alterations**

**11/01/2020**

**JOB DESCRIPTION** Plumber - Jobbing & Alterations

**DISTRICT 8**

**ENTIRE COUNTIES**

Dutchess, Putnam, Westchester

**PARTIAL COUNTIES**

Ulster: Entire county (including Wallkill and Shawangunk Prisons in Town of Shawangunk) EXCEPT for remainder of Town of Shawangunk, and Towns of Plattekill, Marlboro, and Wawarsing.

**WAGES**

Per hour: 07/01/2020

Journeyworker: \$ 44.91

Repairs, replacements and alteration work is any repair or replacement of a present plumbing system that does not change existing roughing or water supply lines.

**SHIFT WORK:**

When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyworker

\$ 31.60

**OVERTIME PAY**

See (B, \*E, E2, Q, V) on OVERTIME PAGE

\*When used as a make-up day, hours after 8 on Saturday shall be paid at time and one half.

**HOLIDAY**

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 16, 25) on HOLIDAY PAGE

**REGISTERED APPRENTICES**

(1) year terms at the following wages:

1st year	\$ 19.52
2nd year	21.65
3rd year	23.42
4th year	32.92
5th year	34.76

Supplemental Benefits per hour:

1st year	\$ 10.21
2nd year	12.05
3rd year	15.88
4th year	21.42
5th year	23.29

8-21.3-J&A

**Roofer**

**11/01/2020**

**JOB DESCRIPTION** Roofer

**DISTRICT 9**

**ENTIRE COUNTIES**

Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

**WAGES**

Per Hour: 07/01/2020

Roofer/Waterproofer \$ 44.25  
+ \$7.00\*

\* This portion is not subject to overtime premiums.

Note: Abatement/Removal of Asbestos containing roofs and roofing material is classified as Roofer.

**SUPPLEMENTAL BENEFITS**

Per Hour: \$ 27.87

**OVERTIME PAY**

See (B, H) on OVERTIME PAGE

Note: An observed holiday that falls on a Sunday will be observed the following Monday.

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6) on HOLIDAY PAGE

### REGISTERED APPRENTICES

( 1 ) year term

1st	2nd	3rd	4th
\$ 15.49	\$ 22.13	\$ 26.55	\$ 33.19
	+ 3.00*	+ 4.20*	+ 5.26*

Supplements:

1st	2nd	3rd	4th
\$ 3.57	\$ 14.10	\$ 16.85	\$ 20.98

9-8R

### Sheetmetal Worker

11/01/2020

**JOB DESCRIPTION** Sheetmetal Worker

**DISTRICT** 8

### ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

### WAGES

07/01/2020

SheetMetal Worker \$ 43.65  
+ 3.27\*

\*This portion is not subject to overtime premiums.

### SHIFT WORK

For all NYS D.O.T. and other Governmental mandated off-shift work:

10% increase for additional shifts for a minimum of five (5) days

### SUPPLEMENTAL BENEFITS

Journeyworker \$ 42.55

### OVERTIME PAY

OVERTIME: See ( B, E, Q, ) on OVERTIME PAGE.

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6, 8, 15, 16, 23) on HOLIDAY PAGE

### REGISTERED APPRENTICES

1st	2nd	3rd	4th	5th	6th	7th	8th
\$ 16.16	\$ 18.18	\$ 20.21	\$ 22.23	\$ 24.24	\$ 26.27	\$ 28.77	\$ 31.27
+ 1.31*	+ 1.47*	+ 1.64*	+ 1.80*	+ 1.96*	+ 2.13*	+ 2.29*	+ 2.45*

\*This portion is not subject to overtime premiums.

Supplemental Benefits per hour:

Apprentices

1st term	\$ 18.31
2nd term	20.60
3rd term	22.88
4th term	25.19
5th term	27.47
6th term	29.75
7th term	31.56
8th term	33.39

8-38

### Sheetmetal Worker

11/01/2020

**JOB DESCRIPTION** Sheetmetal Worker

**DISTRICT** 4

### ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

### WAGES

Per Hour: 07/01/2020 8/01/2020  
Sign Erector \$ 50.79 \$ 52.29

NOTE: Structurally Supported Overhead Highway Signs(See STRUCTURAL IRON WORKER CLASS)

### SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2020	8/01/2020
Sign Erector	\$ 49.82	\$ 51.26

### OVERTIME PAY

See (A, F, S) on OVERTIME PAGE

### HOLIDAY

Paid: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE  
Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

### REGISTERED APPRENTICES

Per Hour:  
6 month Terms at the following percentage of Sign Erectors wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
35%	40%	45%	50%	55%	60%	65%	70%	75%	80%

### SUPPLEMENTAL BENEFITS

Per Hour:

07/01/2020

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 13.96	\$ 15.81	\$ 17.68	\$ 19.56	\$ 27.26	\$ 29.65	\$ 32.80	\$ 35.26	\$ 37.71	\$ 40.15

8/01/2020

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 14.34	\$ 16.26	\$ 18.17	\$ 20.10	\$ 28.02	\$ 30.47	\$ 33.72	\$ 36.27	\$ 38.77	\$ 41.29
									4-137-SE

### Sprinkler Fitter

11/01/2020

### JOB DESCRIPTION Sprinkler Fitter

DISTRICT 1

### ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

### WAGES

Per hour

07/01/2020

Sprinkler Fitter	\$ 45.52
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### SUPPLEMENTAL BENEFITS

Per hour

Journeyman	\$ 27.57
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### OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

### HOLIDAY

Paid: See (1) on HOLIDAY PAGE  
Overtime: See (5, 6) on HOLIDAY PAGE

Note: When a holiday falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double time rate. When a holiday falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double time rate.

### REGISTERED APPRENTICES

Wages per hour

One Half Year terms at the following percentage of journeyman's wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 21.97	\$ 24.41	\$ 26.59	\$ 29.02	\$ 31.45	\$ 33.88	\$ 36.31	\$ 38.74	\$ 41.17	\$ 43.60

Supplemental Benefits per hour

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 8.27	\$ 8.27	\$ 18.70	\$ 18.70	\$ 18.95	\$ 18.95	\$ 18.95	\$ 18.95	\$ 18.95	\$ 18.95
									1-669.2



**Teamster - Building / Heavy&Highway**

**11/01/2020**

**JOB DESCRIPTION** Teamster - Building / Heavy&Highway

**DISTRICT 8**

**ENTIRE COUNTIES**

Putnam, Westchester

**WAGES**

GROUP A: Straight Trucks (6-wheeler and 10-wheeler), A-frame, Winch, Dynamite Seeding, Mulching, Agitator, Water, Attenuator, Light Towers, Cement (all types), Suburban, Station Wagons, Cars, Pick Ups, any vehicle carrying materials of any kind.

GROUP AA: Tack Coat

GROUP B: Tractor & Trailers (all types).

GROUP BB: Tri-Axle, 14 Wheeler

GROUP C: Low Boy (carrying equipment).

GROUP D: Fuel Trucks, Tire Trucks.

GROUP E: Off-road Equipment (over 40 tons): Athey Wagons, Belly Dumps, Articulated Dumps, Trailer Wagons.

GROUP F: Off-road Equipment (over 40 tons) Euclid, DJB.

GROUP G: Off-road Equipment (under 40 tons) Athey Wagons, Belly Articulated Dumps, Trailer Wagons.

GROUP H: Off-road Equipment (under 40 tons), Euclid.

GROUP HH: Off-road Equipment (under 40 tons) D.J.B.

GROUP I: Off-road Equipment (under 40 tons) Darts.

GROUP II: Off-road Equipment (under 40 tons) RXS.

WAGES:(per hour)

07/01/2020

GROUP A	\$ 42.47*
GROUP AA	45.27*
GROUP B	43.09*
GROUP BB	42.59*
GROUP C	45.22*
GROUP D	42.92*
GROUP E	43.47*
GROUP F	44.47*
GROUP G	43.22*
GROUP H	43.84*
GROUP HH	44.22*
GROUP I	43.97*
GROUP II	44.34*

\* To calculate premium wage, subtract \$ .20 from the hourly wage.

Note: Fuel truck operators on construction sites addit. \$5.00 per day.

For work on hazardous/toxic waste site addit. 20% of hourly rate.

Shift Differential: NYS DOT or other Governmental Agency contracts shall receive a shift differential of Fifteen(15%) percent above the wage rate

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

**SUPPLEMENTAL BENEFITS**

Per hour:

Journeyworker

First 40 hours	\$ 33.64
41st-45th hours	15.18
Over 45 hours	0.26

**OVERTIME PAY**

See (B, E, P, R) on OVERTIME PAGE

**HOLIDAY**

Paid: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

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**Welder****11/01/2020**

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**JOB DESCRIPTION** Welder**DISTRICT 1****ENTIRE COUNTIES**

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

**WAGES**

Per hour 07/01/2020

Welder: To be paid the same rate of the mechanic performing the work.\*

\*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

**OVERTIME PAY****HOLIDAY**

1-As Per Trade

## Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

- ( AA ) Time and one half of the hourly rate after 7 and one half hours per day
- ( A ) Time and one half of the hourly rate after 7 hours per day
- ( B ) Time and one half of the hourly rate after 8 hours per day
- ( B1 ) Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday.  
Double the hourly rate for all additional hours
- ( B2 ) Time and one half of the hourly rate after 40 hours per week
- ( C ) Double the hourly rate after 7 hours per day
- ( C1 ) Double the hourly rate after 7 and one half hours per day
- ( D ) Double the hourly rate after 8 hours per day
- ( D1 ) Double the hourly rate after 9 hours per day
- ( E ) Time and one half of the hourly rate on Saturday
- ( E1 ) Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
- ( E2 ) Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- ( E3 ) Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
- ( E4 ) Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- ( E5 ) Double time after 8 hours on Saturdays
- ( F ) Time and one half of the hourly rate on Saturday and Sunday
- ( G ) Time and one half of the hourly rate on Saturday and Holidays
- ( H ) Time and one half of the hourly rate on Saturday, Sunday, and Holidays
- ( I ) Time and one half of the hourly rate on Sunday
- ( J ) Time and one half of the hourly rate on Sunday and Holidays
- ( K ) Time and one half of the hourly rate on Holidays
- ( L ) Double the hourly rate on Saturday
- ( M ) Double the hourly rate on Saturday and Sunday
- ( N ) Double the hourly rate on Saturday and Holidays
- ( O ) Double the hourly rate on Saturday, Sunday, and Holidays
- ( P ) Double the hourly rate on Sunday
- ( Q ) Double the hourly rate on Sunday and Holidays
- ( R ) Double the hourly rate on Holidays
- ( S ) Two and one half times the hourly rate for Holidays

- ( S1 ) Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
- ( T ) Triple the hourly rate for Holidays
- ( U ) Four times the hourly rate for Holidays
- ( V ) Including benefits at SAME PREMIUM as shown for overtime
- ( W ) Time and one half for benefits on all overtime hours.
- ( X ) Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

## Holiday Codes

### PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

### OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

- ( 1 )        None
- ( 2 )        Labor Day
- ( 3 )        Memorial Day and Labor Day
- ( 4 )        Memorial Day and July 4th
- ( 5 )        Memorial Day, July 4th, and Labor Day
- ( 6 )        New Year's, Thanksgiving, and Christmas
- ( 7 )        Lincoln's Birthday, Washington's Birthday, and Veterans Day
- ( 8 )        Good Friday
- ( 9 )        Lincoln's Birthday
- ( 10 )       Washington's Birthday
- ( 11 )       Columbus Day
- ( 12 )       Election Day
- ( 13 )       Presidential Election Day
- ( 14 )       1/2 Day on Presidential Election Day
- ( 15 )       Veterans Day
- ( 16 )       Day after Thanksgiving
- ( 17 )       July 4th
- ( 18 )       1/2 Day before Christmas
- ( 19 )       1/2 Day before New Years
- ( 20 )       Thanksgiving
- ( 21 )       New Year's Day
- ( 22 )       Christmas
- ( 23 )       Day before Christmas
- ( 24 )       Day before New Year's
- ( 25 )       Presidents' Day
- ( 26 )       Martin Luther King, Jr. Day
- ( 27 )       Memorial Day
- ( 28 )       Easter Sunday



New York State Department of Labor - Bureau of Public Work  
State Office Building Campus  
Building 12 - Room 130  
Albany, New York 12240

**REQUEST FOR WAGE AND SUPPLEMENT INFORMATION**

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

**This Form Must Be Typed**

Submitted By:

(Check Only One)

☐

Contracting Agency

☐

Architect or Engineering Firm

☐

Public Work District Office

Date:

**A. Public Work Contract to be let by:** (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address ☐ (Check if new or change)

Telephone: ( )

Fax: ( )

E-Mail:

2. NY State Units (see Item 5)

☐ 01 DOT

☐ 02 OGS

☐ 03 Dormitory Authority

☐ 04 State University  
Construction Fund

☐ 05 Mental Hygiene  
Facilities Corp.

☐ 06 OTHER N.Y. STATE UNIT

☐ 07 City

☐ 08 Local School District

☐ 09 Special Local District, i.e.,  
Fire, Sewer, Water District

☐ 10 Village

☐ 11 Town

☐ 12 County

☐ 13 Other Non-N.Y. State  
(Describe)

3. SEND REPLY TO ☐ (check if new or change)  
Name and complete address:

Telephone:( )

Fax: ( )

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

☐ New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

☐ Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR  
THIS PROJECT :

OFFICE USE ONLY

**B. PROJECT PARTICULARS**

5. Project Title \_\_\_\_\_

Description of Work \_\_\_\_\_

Contract Identification Number \_\_\_\_\_

Note: For NYS units, the OSC Contract No. \_\_\_\_\_

6. Location of Project:  
Location on Site \_\_\_\_\_

Route No/Street Address \_\_\_\_\_

Village or City \_\_\_\_\_

Town \_\_\_\_\_

County \_\_\_\_\_

7. Nature of Project - Check One:

- ☐ 1. New Building
- ☐ 2. Addition to Existing Structure
- ☐ 3. Heavy and Highway Construction (New and Repair)
- ☐ 4. New Sewer or Waterline
- ☐ 5. Other New Construction (Explain)
- ☐ 6. Other Reconstruction, Maintenance, Repair or Alteration
- ☐ 7. Demolition
- ☐ 8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- ☐ Construction (Building, Heavy Highway/Sewer/Water)
- ☐ Tunnel
- ☐ Residential
- ☐ Landscape Maintenance
- ☐ Elevator maintenance
- ☐ Exterminators, Fumigators
- ☐ Fire Safety Director, NYC Only
- ☐ Guards, Watchmen
- ☐ Janitors, Porters, Cleaners, Elevator Operators
- ☐ Moving furniture and equipment
- ☐ Trash and refuse removal
- ☐ Window cleaners
- ☐ Other (Describe)

9. Has this project been reviewed for compliance with the Wicks Law involving separate bidding?

YES ☐ NO ☐

10. Name and Title of Requester

Signature



NEW YORK STATE DEPARTMENT OF LABOR  
Bureau of Public Work - Debarment List

**LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE  
AWARDED ANY PUBLIC WORK CONTRACT**

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

**Debarment Database:** To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: <https://applications.labor.ny.gov/EDList/searchPage.do>

**For inquiries where WCB is listed as the "Agency", please call 1-866-546-9322**





**NYSDOL Bureau of Public Work Debarment List 07/28/2020**

**Article 8**

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	NYC	*****9839	A.J.S. PROJECT MANAGEMENT, INC.		149 FIFTH AVENUE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL	*****3344	ACT INC		6409 LAND O LAKES BLVD LAND O LAKES FL 34638	11/10/2015	11/10/2020
DOL	DOL	*****4018	ADIRONDACK BUILDING RESTORATION INC.		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	AG	*****1812	ADVANCED BUILDERS & LAND DEVELOPMENT, INC.		400 OSER AVE #2300HAUPPAUGE NY 11788	09/11/2019	09/11/2024
DOL	DOL	*****1687	ADVANCED SAFETY SPRINKLER INC		261 MILL ROAD P.O BOX 296EAST AURORA NY 14052	07/29/2015	07/29/2020
DOL	DOL	*****1687	ADVANCED SAFETY SPRINKLER INC		261 MILL ROAD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	NYC	*****6775	ADVENTURE MASONRY CORP.		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC		AGOSTINHO TOME		405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
DOL	DOL		AJ TORCHIA		10153 ROBERTS RD SAUQUOIT NY 13456	08/09/2016	08/09/2021
DOL	DOL	*****3344	ALL CATASTROPHE CONSTRUCTION TEAM INC	ACT INC	6409 LAND O LAKES BLVD LAND O LAKES FL 34638	11/10/2015	11/10/2020
DOL	DOL		AMADEO J TORCHIA	TORCHIA'S HOME IMPROVEMENT	10153 ROBERTS RD SAUQUOIT NY 13456	08/09/2016	08/09/2021
DOL	NYC		AMJAD NAZIR		2366 61ST ST BROOKLYN NY 11204	12/15/2016	12/15/2021
DOL	DOL		ANGELO F COKER			12/04/2018	12/04/2023
DOL	NYC		ANISUL ISLAM		C/O RELIANCE GENERAL CONS 644 OCEAN PARKWAYBROOKLYN NY 11230	09/02/2015	09/02/2020
DOL	DOL		ANITA SALERNO		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	NYC		ANTHONY J SCLAFANI		149 FIFTH AVE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL		ANTHONY PERGOLA		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10323	01/23/2017	01/23/2022
DOL	DOL		ANTONIO ESTIVEZ		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3020	APCO CONTRACTING CORP		24 SOUTH MARYLAND AVENUE PORT WASHINGTON NY 11050	09/24/2012	09/02/2020
DOL	DOL		ARNOLD A. PAOLINI		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC		ARSHAD MEHMOOD		168-42 88TH AVENUE JAMAICA NY 11432	11/20/2019	11/20/2024
DOL	DOL		ARVINDER ATWAL		65 KENNETH PLACE NEW HYDE PARK NY 11040	07/19/2017	07/19/2022
DOL	NYC	*****4779	ASTORIA GENERAL CONTRACTING CORP		35-34 31ST STREET LONG ISLAND CITY NY 11106	09/02/2015	09/02/2020
DOL	NYC	*****7217	ASTRO COMMUNICATIONS OF NY CORP		79 ALEXANDER AVE- STE 36A BRONX NY 10454	10/30/2015	10/30/2020
DOL	NYC	*****6683	ATLAS RESTORATION CORP.		35-12 19TH AVENUE ASTORIA NY 11105	08/02/2017	08/02/2022
DOL	NYC	*****5532	ATWAL MECHANICALS, INC		65 KENNETH PLACE NEW HYDE PARK NY 11040	07/19/2017	07/19/2022
DOL	NYC	*****2591	AVI 212 INC.		260 CROPEY AVENUE APT 11GBROOKLYN NY 11214	10/30/2018	10/30/2023
DOL	AG		AVTAR SINGH		116-24 127TH STREET SOUTH OZONE PARK NY 11420	12/22/2015	12/22/2020
DOL	AG		BALDEV SINGH		116-24 127TH STREET SOUTH OZONE PARK NY 11420	12/22/2015	12/22/2020
DOL	NYC		BALWINDER SINGH		421 HUDSON ST SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	DOL		BARRY KINNEY		6409 LAND O LAKES BLVD LAND O LAKES FL 34638	11/10/2015	11/10/2020

**NYSDOL Bureau of Public Work Debarment List 07/28/2020**

**Article 8**

DOL	NYC	*****3915	BEACON RESTORATION INC		SUITE B-8 782 PELHAM PARKWAY SOUTHBRONX NY 10462	04/21/2016	04/21/2021
DOL	NYC	*****8416	BEAM CONSTRUCTION, INC.		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	DOL		BIAGIO CANTISANI			06/12/2018	06/12/2023
DOL	DOL	*****4512	BOB BRUNO EXCAVATING, INC		5 MORNINGSIDE DR AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		BOGDAN MARKOVSKI		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ 07601	02/11/2019	02/11/2024
DOL	DOL	*****8551	BRANDY'S MASONRY		216 WESTBROOK STREET P O BOX 304SAYRE PA 18840	08/09/2016	08/09/2021
DOL	DOL	*****1449	BRRESTORATION NY INC		140 ARCADIA AVENUE OSWEGO NY 13126	09/12/2016	09/12/2021
DOL	DOL		BRUCE MORSEY		C/O KENT HOLLOW SIDING LL 29A BRIDGE STREETNEW MILFORD CT 06776	01/15/2016	01/15/2021
DOL	DOL		BRUCE P. NASH JR.		5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
DOL	DOL	*****0225	C&D LAFACE CONSTRUCTION, INC.		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****8809	C.B.E. CONTRACTING CORPORATION		310 MCGUINESS BLVD GREENPOINT NY 11222	03/07/2017	03/07/2022
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	NYC		CALVIN WALTERS		465 EAST THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL		CANTISANI & ASSOCIATES LTD		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CANTISANI HOLDING LLC			06/12/2018	06/12/2023
DOL	DOL		CARIBBEAN POOLS		C/O DOUGLAS L MALARKEY 64 VICTORIA DRIVEBINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DOL		CARMEN RACHETTA		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	02/03/2025
DOL	DOL		CARMENA RACHETTA		8531 OSWEGO ROAD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****3812	CARMODY "2" INC			06/12/2018	06/12/2023
DOL	DOL	*****1143	CARMODY BUILDING CORP	CARMODY CONTRACTIN G AND CARMODY CONTRACTIN G CORP.	442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY CONCRETE CORPORATION			06/12/2018	06/12/2023
DOL	DOL		CARMODY ENTERPRISES, LTD.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY INC		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3812	CARMODY INDUSTRIES INC			06/12/2018	06/12/2023
DOL	DOL		CARMODY MAINTENANCE CORPORATION		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY MASONRY CORP		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****8809	CBE CONTRACTING CORP		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	AG		CESAR J. AGUDELO		81-06 34TH AVENUE APT. 6EJACKSON HEIGHTS NY 11372	02/07/2018	02/07/2023
DOL	DOL	*****7655	CHAMPION CONSTRUCTION SERVICES CORP		2131 SCHENECTADY AVENUE BROOKLYN NY 11234	11/18/2015	11/18/2020
DOL	DOL		CHARLES ZIMMER JR		216 WESTBROOK STREET P O BOX 304SAYRE PA 18840	08/09/2016	08/09/2021
DOL	DOL		CHRISTINE J HEARNE		C/O CJ-HEARNE CONSTRUCTIO 131 PONCE DE LEON AVE NEATLANTA GA 30308	12/01/2015	12/01/2020
DOL	DOL		CHRISTOPHER J MAINI		19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023

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DOL	DOL		CHRISTOPHER PAPASTEFANOU A/K/A CHRIS PAPASTEFANOU		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL	*****0671	CJ-HEARNE CONSTRUCTION CO		SUITE 204 131 PONCE DE LEON AVENUEATLANTA GA 30308	12/01/2015	12/01/2020
DOL	DOL	*****1927	CONSTRUCTION PARTS WAREHOUSE, INC.	CPW	5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
DOL	NYC	*****2164	CREATIVE TRUCKING INC		58-83 54TH STREET MASPETH NY 11378	02/26/2016	02/26/2021
DOL	DOL	*****2524	CSI ELECTRICAL & MECHANICAL INC		42-32 235TH ST DOUGLSTON NY 11363	01/14/2019	01/14/2024
DOL	DOL	*****7761	D L MALARKEY CONSTRUCTION		64 VICTORIA DRIVE BINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DOL	*****7888	D L MALARKEY CONSTRUCTION INC		64 VICTORIA DRIVE BINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DOL	*****5629	DAKA PLUMBING AND HEATING LLC		2561 ROUTE 55 POUGHQUAG NY 12570	02/19/2016	02/19/2021
DOL	NYC		DALJIT KAUR BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL		DANICA IVANOSKI		61 WILLETT ST. PASSAIC NJ 07503	10/26/2016	10/26/2021
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL		DAVID MARTINEZ		C/O EMPIRE TILE INC 6 TREMONT COURTHUNTINGTON STATION NY 11746	03/08/2016	03/08/2021
DOL	NYC		DAVID WEINER		14 NEW DROP LANE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	DOL		DEBBIE STURDEVANT		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	AG		DEBRA MARTINEZ		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		DEDA GAZIVODAN		C/O DAKA PLUMBING AND H 2561 ROUTE 55POUGHQUAG NY 12570	02/19/2016	02/19/2021
DOL	DOL		DELPHI PAINTING & DECORATING CO INC		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		DENNIS SCHWANDTNER		C/O YES SERVICE AND REPAIR 145 LODGE AVEHUNTINGTON STATION NY 11476	08/09/2016	08/09/2021
DOL	DOL		DF CONTRACTORS OF ROCHESTER, INC.		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	DOL		DF CONTRACTORS, INC.		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	NYC		DIMITRIOS KOUTSOUKOS		C/O ASTORIA GENERAL CONTR 35-34 31ST STREETLONG ISLAND CITY NY 11106	09/02/2015	09/02/2020
DOL	NYC		DIMITRIOS TSOUMAS		35-12 19TH AVENUE ASTORIA NY 11105	08/02/2017	08/02/2022
DOL	DOL		DOMENICO LAFACE		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****3242	DONALD R. FORSAY	DF LAWN SERVICE	1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	DOL		DONALD R. FORSAY		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	DOL		DORIS SKODA		C/O APCO CONTRACTING CORP 24 SOUTH MARYLAND AVENUEPORT WASHINGTON NY 11050	09/24/2012	09/02/2020
DOL	NYC	*****7404	DOSANJH CONSTRUCTION CORP		9439 212TH STREET QUEENS VILLAGE NY 11428	02/25/2016	02/25/2021
DOL	DOL		DOUGLAS L MALARKEY	MALARKEY CONSTRUCTI ON	64 VICTORIA DRIVE B INGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	NYC		DUARTE LOPES		66-05 WOODHAVEN BLVD. STE 2REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	DOL		E C WEBB		6409 LAND O LAKES BLVD LAND O LAKES FL 34638	11/10/2015	11/10/2020
DOL	DOL	*****5175	EAGLE MECHANICAL AND GENERAL CONSTRUCTION LLC		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025

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DOL	DOL		EARL L WILSON	WILSON BROTHER DRYWALL CONTRACTORS	36 ABERSOLD STREET ROCHESTER NY 14621	08/31/2015	08/31/2020
DOL	DOL		EAST COAST PAVING		2238 BAKER RD GILLET PA 16923	03/12/2018	03/12/2023
DOL	NYC	*****4269	EAST PORT EXCAVATION & UTILITIES		601 PORTION RD RONKONKOMA NY 11779	11/18/2016	11/18/2021
DOL	DOL	*****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	DOL	*****3270	EMPIRE TILE INC		6 TREMONT COURT HUNTINGTON STATION NY 11746	03/08/2016	03/08/2021
DOL	NYC	*****5917	EPOCH ELECTRICAL, INC		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2024
DOL	DOL	*****7403	F & B PAINTING CONTRACTING INC		2 PARKVIEW AVENUE HARRISON NY 10604	09/26/2016	09/26/2021
DOL	DOL		FAIGY LOWINGER		11 MOUNTAIN RD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL		FAY MATTHEW		C/O CHAMPION CONSTRUCTION 2131 SCHENECTADY AVENUEBROOKLYN NY 11234	11/18/2015	11/18/2020
DOL	DOL		FAZIA GINA ALI-MOHAMMED	C/O CHAMPION CONSTRUCTION	2131 SCHENECTADY AVENUE BROOKLYN NY 11234	11/18/2015	11/18/2020
DOL	DOL		FRANK BENEDETTO		19 CATLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	DOL		FRANK BENEDETTO		C/O F & B PAINTING CONTRA 2 PARKVIEW AVENUEHARRISON NY 10604	09/26/2016	09/26/2021
DOL	DOL	*****4722	FRANK BENEDETTO AND CHRISTOPHER J MAINI	B & M CONCRETE	19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	NYC		FRANK MAINI		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	NYC	*****6616	G & G MECHANICAL ENTERPRISES, LLC.		1936 HEMPSTEAD TURNPIKE EAST MEDOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		GABRIEL FRASSETTI			04/10/2019	04/10/2024
DOL	DOL		GALINDA ROTENBERG		C/O GMDV TRANS INC 67-48 182ND STREETFRESH MEADOWS NY 11365	06/24/2016	06/24/2021
DOL	DOL		GEOFF CORLETT		415 FLAGGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DOL		GIGI SCHNECKENBURGER		261 MILL RD EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		GIOVANNI LAFACE		8531 OSWEGO RD BALDWINSVILLE NY 13027	02/03/2020	01/09/2023
DOL	NYC	*****3164	GLOBE GATES INC	GLOBAL OVERHEAD DOORS	405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
DOL	DOL	*****5674	GMDV TRANS INC		67-48 182ND STREET FRESH MEADOWS NY 11365	06/24/2016	06/24/2021
DOL	NYC		GREAT ESTATE CONSTRUCTION, INC.		327 STAGG ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	DOL		GREGORY S. OLSON		P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		HANS RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC		HARMEL SINGH		15 CLINTON LANE HICKSVILLE NY 11801	02/25/2016	02/25/2021
DOL	NYC		HAROLD KUEMMEL		58-83 54TH STREET MASPETH NY 11378	02/26/2016	02/26/2021
DOL	NYC	*****3228	HEIGHTS ELEVATOR CORP.		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	DOL		HENRY VAN DALRYMPLE		2663 LANTERN LANE ATLANTA GA 30349	12/01/2015	12/01/2020
DOL	DOL	*****8282	IDEMA DEVELOPMENT INC		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020

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DOL	DOL	*****8282	IDEMA GENERAL CONTRACTORS INC		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020
DOL	DOL	*****7001	INTEGRATED CONSTRUCTION & POWER SYSTEMS INC		SUITE 100 2105 W GENESEE STREETS YRACUSE NY 13219	01/06/2016	01/06/2021
DOL	DOL	*****5131	INTEGRITY MASONRY, INC.	M&R CONCRETE	722 8TH AVE WATERVLIET NY 12189	06/05/2018	06/05/2023
DOL	DOL		IRENE KASELIS		32 PENNINGTON AVE WALDWICK NJ 07463	05/30/2019	05/30/2024
DOL	AG		J A M CONSTRUCTION CORP		SUITE 125 265 SUNRISE HIGHWAY ROCKVILLE CENTRE NY 10457	04/07/2016	04/07/2021
DOL	DOL		J.A. HIRES CADWALLADER		P.O BOX 100 200 LATT BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JAMES B RHYNDERS		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020
DOL	DOL		JAMES C. DELGIACCO		722 8TH AVE WATERVLIET NY 12189	06/05/2018	06/05/2023
DOL	DOL		JAMES E RHYNDERS		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020
DOL	AG		JAMES FALCONE		SUITE 125 265 SUNRISE HIGHWAY ROCKVILLE CENTRE NY 10457	04/07/2016	04/07/2021
DOL	DOL		JAMES LIACONE		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		JAMES RACHEL		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		JAMES RHYNDERS SR		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020
DOL	DOL		JASON W MILLIMAN		C/O ROCHESTER ACOUSTICAL P O BOX 799 HILTON NY 14468	02/19/2016	02/19/2021
DOL	DOL	*****5368	JCH MASONRY & LANDSCAPING INC.		35 CLINTON AVE OSSINING NY 10562	09/12/2018	09/12/2023
DOL	NYC		JENNIFER GUERRERO		1936 HEMPSTEAD TURNPIKE EAST MEADOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		JESSICA WHITESIDE		C/O BRRESTORATION NY INC 140 ARCADIA AVENUE OSWEGO NY 13126	09/12/2016	09/12/2021
DOL	AG		JOHN ANTHONY MASSINO		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JOHN F. CADWALLADER		200 LATT BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4612	JOHN F. CADWALLADER, INC.	THE GLASS COMPANY	P.O BOX 100 200 LATT BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JOHN GOCEK		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	AG	*****0600	JOHNCO CONTRACTING, INC.		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JON E DEYOUNG		261 MILL RD P.O BOX 296 EAST AURORA NY 14052	07/29/2015	07/29/2020
DOL	DOL		JON E DEYOUNG		261 MILL RD P.O BOX 296 EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		JORI PEDERSEN		415 FLAGER AVE #302 STUART FL 34994	10/31/2018	10/31/2023
DOL	DOL		JOSE CHUCHUCA		35 CLINTON AVE OSSINING NY 10562	09/12/2018	09/12/2023
DOL	AG		JOSEPH FALCONE		SUITE 125 265 SUNRISE HIGHWAY ROCKVILLE CENTRE NY 10457	04/07/2016	04/07/2021
DOL	NYC		JOSEPH FOLEY		66-05 WOODHAVEN BLVD. STE 2 REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	DOL	*****9273	JOSEPH M LOVETRO		P O BOX 812 BUFFALO NY 14220	08/09/2016	08/09/2021
DOL	NYC		JOSEPH MARTINO		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	DOL		JOY MARTIN		2404 DELAWARE AVE NIGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002

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DOL	DOL	*****5062	K R F SITE DEVELOPMENT INC		375 LAKE SHORE DRIVE PUTNAM VALLEY NY 10579	01/23/2017	01/23/2022
DOL	NYC		K.S. CONTRACTING CORP.		29 PHILLIP DRIVE PARSIPPANY NJ 07054	02/13/2017	02/13/2022
DOL	DOL		KATIE BURDICK		2238 BAKER RD GILLET PA 16923	03/12/2018	03/12/2023
DOL	DOL		KENNETH FIORENTINO		375 LAKE SHORE DRIVE PUTNAM VALLEY NY 10579	01/23/2017	01/23/2022
DOL	DOL	*****9732	KENT HOLLOW SIDING LLC		29A BRIDGE STREET NEW MILFORD CT 06776	01/15/2016	01/15/2021
DOL	DOL		KIM SOROCENSKI		C/O SOLUTION MATTERS INC 198 NORWOOD ROADPORT JEFFERSON NY 11776	11/19/2015	11/19/2020
DOL	DOL	*****3490	L & M CONSTRUCTION/DRYWALL INC.		1079 YONKERS AVE YONKERS NY 10704	08/07/2018	08/07/2023
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	AG	*****4643	LALO DRYWALL, INC.		221 OLD FORD ROAD NEW PLATZ NY 12561	05/20/2016	05/20/2021
DOL	DOL	*****4505	LARAPINTA ASSOCIATES INC		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	DOL		LAVERN GLAVE		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	08/14/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	08/14/2017	08/14/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	DA	*****4460	LONG ISLAND GLASS & STOREFRONTS, LLC		4 MANHASSET TRL RIDGE NY 11961	09/06/2018	09/06/2023
DOL	AG	*****4216	LOTUS-C CORP.		81-06 34TH AVENUE APT. 6EJACKSON HEIGHTS NY 11372	02/07/2018	02/07/2023
DOL	NYC		LUBOMIR PETER SVOBODA		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	AG		LUIS MARTINEZ	LALO DRYWALL	211 MAIN ST. NEW PALTZ NY 12561	05/20/2016	05/20/2021
DOL	NYC		M & L STEEL & ORNAMENTAL IRON CORP.		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	DOL		M ANVER BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	AG	*****6957	M B DIN CONSTRUCTION INC		8831 20TH AVENUE/SUITE 6E BROOKLYN NY 11214	11/17/2015	11/17/2020
DOL	DOL		M. ANVER BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	NYC	*****9590	MACK GLASSNAUTH IRON WORKS INC		137 LIBERTY AVENUE BROOKLYN NY 11212	12/21/2015	12/21/2020
DOL	DOL	*****1784	MADISON AVE CONSTRUCTION CORP		39 PENNY STREET WEST ISLIP NY 11795	11/02/2016	11/02/2021

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DOL	DOL		MALARKEY'S BAR & GRILL LLC		64 VICTORIA DRIVE BINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DOL	*****0705	MALARKEY'S PUB & GRUB LLC		64 VICTORIA DRIVE BINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	NYC		MAREK FABIJANOWSKI		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	DOL		MARIACHI'S PIZZERIA		C/O DOUGLAS L MALARKEY 64 VICTORIA DRIVEBINGHAMTON NY 13904	02/04/2016	02/04/2021
DOL	DOL		MARK MIONIS		6409 LAND O LAKES BLVD LAND O LAKES FL 34638	11/10/2015	11/10/2020
DOL	NYC		MARTINE ALTER		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	DOL		MARVIN A STURDEVANT		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	DOL		MASONRY CONSTRUCTION, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3333	MASONRY INDUSTRIES, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	NYC		MATINA KARAGIANNIS		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2023
DOL	DOL		MATTHEW IDEMA GENERAL CONTRACTORS INC		91 COLLEGE AVENUE POUGHKEEPSIE NY 12603	12/04/2015	12/04/2020
DOL	DOL		MATTHEW P. KILGORE		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	DOL		MAURICE GAWENO		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****6416	MCCALL MASONRY		P O BOX 304 SAYRE PA 18840	08/09/2016	08/09/2021
DOL	DOL		MCLEAN "MIKKI BEANE"		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		MCLEAN "MIKKI" DRAKE		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		MCLEAN M DRAKE-BEANE		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL	*****9445	MCLEAN M WALSH	ELITE PROFESSIONAL PAINTING OF CNY	1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL	*****9445	MCLEAN M WALSH	ELITE PROFESSIONAL PAINTING OF CNY	1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	NYC	*****5330	METRO DUCT SYSTEMS INC		1219 ASTORIA BOULEVARD LONG ISLAND CITY NY 11102	04/16/2014	11/19/2020
DOL	DOL		MICHAEL A PASCARELLA		SUITE 100 2105 WEST GENESEE STREET SYRACUSE NY 13219	01/06/2016	01/06/2021
DOL	NYC		MICHAEL HIRSCH		C/O MZM CORP 163 S MAIN STREETNEW CITY NY 10956	01/28/2016	01/28/2021
DOL	DOL		MICHAEL LENIHAN		1079 YONKERS AVE UNIT 4YONKERS NY 10704	08/07/2018	08/07/2023
DOL	AG		MICHAEL RIGLIETTI		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		MICHAEL WILSON	WILSON BROTHER DRYWALL CONTRACTORS	36 ABERSOLD STREET ROCHESTER NY 14621	08/31/2015	08/31/2020
DOL	DOL	*****4829	MILESTONE ENVIRONMENTAL CORPORATION		704 GINESI DRIVE SUITE 29MORGANVILLE NJ 07751	04/10/2019	04/10/2024
DOL	NYC	*****9926	MILLENNIUM FIRE PROTECTION, LLC		325 W. 38TH STREET SUITE 204NEW YORK NY 10018	11/14/2019	11/14/2024
DOL	NYC	*****0627	MILLENNIUM FIRE SERVICES, LLC		14 NEW DROP LNE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	AG		MOHAMMED N CHATHA		8831 20TH AVENUE/SUITE 6E BROOKLYN NY 11214	11/17/2015	11/17/2020
DOL	DOL	*****2737	MOUNTAIN'S AIR INC		2471 OCEAN AVENUE- STE 7A BROOKLYN NY 11229	09/24/2012	09/18/2020

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DOL	NYC	*****3826	MOVING MAVEN OF NY, INC.		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	NYC	*****3550	MOVING MAVEN, INC		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	AG		MSR ELECTRICAL CONSTRUCTION CORP.		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		MUHAMMAD BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	DOL		MUHAMMAD BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	DOL		MUHAMMAD PERVAIZ		C/O CHAMPION CONSTRUCTION 2131 SCHENECTADY AVENUEBROOKLYN NY 11234	11/18/2015	11/18/2020
DOL	NYC	*****3613	MZM CORP		163 S MAIN STREET NEW CITY NY 10956	01/28/2016	01/28/2021
DOL	DA	*****9786	NATIONAL INSULATION & GC CORP		180 MILLER PLACE HICKSVILLE NY 11801	12/12/2018	12/12/2023
DOL	NYC	*****4839	NEW YORK RIGGING CORP		58-83 54TH STREET MASPETH NY 11378	02/26/2016	02/26/2021
DOL	NYC		NICHOLAS FILIPAKIS		7113 FORT HAMILTON PARKWA BROOKLYN NY 11228	12/09/2016	12/09/2021
DOL	DOL	*****6966	NORTH COUNTRY DRYWALL AND PAINT		23167 COUNTY ROUTE 59 DEXTER NY 13634	10/24/2016	10/24/2021
DOL	DOL	*****0065	NORTHEAST LANDSCAPE AND MASONRY ASSOC		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10523	01/23/2017	01/23/2022
DOL	DOL	*****1845	OC ERECTERS, LLC A/K/A OC ERECTERS OF NY INC.		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
DOL	NYC	*****0818	ONE TEN RESTORATION, INC.		2366 61ST ST BROOKLYN NY 11204	12/15/2016	12/15/2021
DOL	NYC		ORSON ARROYO		C/O METRO DUCT SYSTEMS 12-19 ASTORIA BOULEVARDLONG ISLAND CITY NY 11102	04/16/2014	11/19/2020
DOL	NYC		PARESH SHAH		29 PHILLIP DRIVE PARSIPPANY NJ 07054	02/13/2017	02/13/2022
DOL	NYC	*****9422	PELIUM CONSTRUCTION, INC.		22-33 35TH ST. ASTORIA NY 11105	12/30/2016	12/30/2021
DOL	DOL		PETER M PERGOLA		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10523	01/23/2017	01/23/2022
DOL	DOL		PIERRE LAPORT		224 COUNTY HIGHWAY 138 BROADALBIN NY 12025	03/07/2017	03/07/2022
DOL	DOL	*****1543	PJ LAPORT FLOORING INC		224 COUNTY HIGHWAY 138 BROADALBIN NY 12025	03/07/2017	03/07/2022
DOL	NYC	*****5771	PMJ ELECTRICAL CORP		7113 FORT HAMILTON PARKWA BROOKLYN NY 11228	12/09/2016	12/09/2021
DOL	DOL	*****0466	PRECISION BUILT FENCES, INC.		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	NYC	*****4532	PROFESSIONAL PAVERS CORP.		66-05 WOODHAVEN BLVD. REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	DA	*****6817	QUADRANT METAL BUILDINGS LLC		2740 SW MARTIN DOWNS BLVD PALM CITY FL 34990	08/25/2016	08/25/2021
DOL	NYC		RAMESHWAR ASU		137 LIBERTY AVENUE BROOKLYN NY 11212	12/21/2015	12/21/2020
DOL	DOL	*****1068	RATH MECHANICAL CONTRACTORS, INC.		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP		3 PARK CIRCLE MIDDLETOWN NY 10940	01/30/2018	01/30/2023
DOL	AG	*****7015	RCM PAINTING INC.		69-06 GRAND AVENUE 2ND FLOORMASPETH NY 11378	02/07/2018	02/07/2023
DOL	DOL		REGINALD WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	NYC	*****3461	RELIANCE GENERAL CONSTRUCTION INC		644 OCEAN PARKWAY BROOKLYN NY 11230	09/02/2015	09/02/2020
DOL	DA		RIANN MULLER		2740 SW MARTIN DOWNS BLVD PALM CITY FL 34990	08/25/2016	08/25/2021
DOL	DOL	*****9148	RICH T CONSTRUCTION		107 WILLOW WOOD LANE CAMILLUS NY 13031	11/13/2018	11/13/2023
DOL	DOL		RICHARD MACONE		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023



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DOL	DOL		RICHARD REGGIO		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	DOL	*****9148	RICHARD TIMIAN	RICH T CONSTRUCTI ON	108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	11/13/2018	11/13/2023
DOL	DOL		ROBBYE BISSEAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROBERT A. VALERINO		3841 LANYARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		ROBERT BRUNO		3 GAYLORD ST AUBURN NY 13021	11/15/2016	11/15/2021
DOL	DOL		ROBERT BRUNO		5 MORNINGSIDE DRIVE AUBURN NY 13021	05/28/2019	05/28/2024
DOL	NYC		ROBERT HOHMAN		149 FIFTH AVE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL	*****3859	ROCHESTER ACOUSTICAL CORP		P O BOX 799 HILTON NY 14468	02/19/2016	02/19/2021
DOL	DOL		RODERICK PUGH		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	DOL	*****4880	RODERICK PUGH CONSTRUCTION INC.		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	NYC		RODNEY SCOTT		201 HEMPSTEAD AVE WEST HEMPSTEAD NY 11552	10/30/2015	10/30/2020
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL		RONALD MESSEN		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		ROSEANNE CANTISANI			06/12/2018	06/12/2023
DOL	DOL		RYAN ALBIE		21 S HOWELLS POINT ROAD BELLPORT NY 11713	02/21/2017	02/21/2022
DOL	DOL	*****3347	RYAN ALBIE CONTRACTING INC		21 S HOWELLS POINT ROAD BELLPORT NY 11713	02/21/2017	02/21/2022
DOL	DOL	*****1365	S & L PAINTING, INC.		11 MOUNTAIN ROAD P.O BOX 408MONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****7730	S C MARTIN GROUP INC.		2404 DELAWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	NYC		SABIR MUHAMMED		SUITE B-8 782 PELHAM PARKWAY SOUTHBRONX NY 10462	04/21/2016	04/21/2021
DOL	DOL		SALVATORE A FRESINA			08/26/2016	08/26/2021
DOL	DOL		SAM FRESINA			08/26/2016	08/26/2021
DOL	NYC	*****0349	SAM WATERPROOFING INC		168-42 88TH AVENUE APT.1 AJAMAICA NY 11432	11/20/2019	11/20/2024
DOL	NYC		SANDEEP BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	NYC	*****2117	SCOTT ELECTRICAL SERVICE, LLC.		201 HEMPSTEAD AVE WEST HEMPSTEAD NY 11552	10/30/2015	10/30/2020
DOL	DOL	*****9751	SCW CONSTRUCTION		544 OLD ROUTE 23 ACRE NY 12405	02/14/2017	02/14/2022
DOL	AG		SERGIO RAYMUNDO		109 DUBOIS RD. NEW PALTZ NY 12561	05/20/2016	05/20/2021
DOL	NYC	*****6597	SHAIRA CONSTRUCTION CORP.		421 HUDSON STREET SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	DOL	*****1961	SHANE BURDICK	CENTRAL TRAFFIC CONTROL, LLC.	2238 BAKER ROAD GILLET PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE BURDICK		2238 BAKER ROAD GILLET PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE NOLAN		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		SHULEM LOWINGER		11 MOUNTAIN ROAD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****0816	SOLAR ARRAY SOLUTIONS, LLC		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023

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DOL	DOL	****4025	SOLUTION MATTERS INC		198 NORWOOD ROAD PORT JEFFERSON NY 11776	11/19/2015	11/19/2020
DOL	DOL	****2221	SOUTH BUFFALO ELECTRIC, INC.		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	DOL	****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	****6844	STEAM PLANT AND CHX SYSTEMS INC.		14B COMMERCIAL AVENUE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL	****9933	STEED GENERAL CONTRACTORS, INC.		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		STEFANOS PAPASTEFANOU, JR. A/K/A STEVE PAPASTEFANOU, JR.		256 WEST SADDLE RIVER RD UPPER SADDLE RIVER NJ 07458	05/30/2019	05/30/2024
DOL	DOL	****9751	STEPHEN C WAGAR		544 OLD ROUTE 23 ACRE NY 12405	02/14/2017	02/14/2022
DOL	DOL		STEVE TATE		415 FLAGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	NYC		STEVEN GOVERNALE		601 PORTION RD RONKONKOMA NY 11779	11/18/2016	11/18/2021
DOL	DOL		STEVEN MARTIN		2404 DELWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	DOL		STEVEN P SUCATO		15-68 208TH STREET BAYSIDE NY 11360	06/23/2016	06/23/2021
DOL	DOL		STEVEN TESTA		50 SALEM STREET - BLDG B LYNNFIELD MA 01940	01/23/2017	01/23/2022
DOL	NYC	****9432	SUBLINK LTD		346 THIRD AVENUE PELHAM NY 10803	11/19/2015	11/19/2020
DOL	NYC	****5863	SUKHMANY CONSTRUCTION, INC.		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL	****1060	SUNN ENTERPRISES GROUP, LLC		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ 07601	02/11/2019	02/11/2024
DOL	DOL	****8209	SYRACUSE SCALES, INC.		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	DOL		TALAILA OCAMPA		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
DOL	DOL	****9852	TAP STEEL INC		ROUTE 26 3101 P O BOX 457CONSTABLEVILLE NY 13325	01/28/2016	01/28/2021
DOL	DOL		TERRY THOMPSON		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL		TEST		P.O BOX 123 ALBANY NY 12204	05/20/2020	05/20/2025
DOL	DOL	****5570	TESTA CORP		50 SALEM STREET - BLDG B LYNNFIELD MA 01940	01/23/2017	01/23/2022
DOL	DOL	****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL	****8174	THE DALRYMPLE CORPORATION		UNIT 278 541 10TH STREET NWLANTA GA 30318	12/01/2015	12/01/2020
DOL	DOL	****8174	THE DALRYMPLE GROUP LLC		289 JONESBORO RD/ STE 216 MCDONOUGH GA 30253	12/01/2015	12/01/2020
DOL	DOL		TIMOTHY A PALUCK		C/O TAP STEEL INC RTE 26 3101/ P O BOX 457CONSTABLEVILLE NY 13325	01/28/2016	01/28/2021
DOL	DOL	****3453	TORCHIA'S HOME IMPROVEMENT		10153 ROBERTS RD SAUQUOIT NY 13456	08/09/2016	08/09/2021
DOL	DOL	****8311	TRIPLE B FABRICATING, INC.		61 WILLETT ST. PASSAIC NJ 07503	10/26/2016	10/26/2021
DOL	DOL	****9407	TURBO GROUP INC		15-68 208TH STREET BAYSIDE NY 11360	06/23/2016	06/23/2021
DOL	DOL	****6392	V.M.K CORP.		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023
DOL	NYC		VALERIE VISCONTI		346 THIRD AVENUE PELHAM NY 10803	11/19/2015	11/19/2020
DOL	NYC	****7361	VIALE HOLDINGS, INC.	MOVING MAVEN	1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	DOL		VICTOR ALICANTI		42-32 235TH ST DOUGLSTON NY 11363	01/14/2019	01/14/2024
DOL	DOL		VICTOR ROTENBERG		C/O GMDV TRANS INC 67048 182ND STREETFRESH MEADOWS NY 11365	06/24/2016	06/24/2021
DOL	NYC		VIKTAR PATONICH		2630 CROSEY AVE BROOKLYN NY 11214	10/30/2018	10/30/2023

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DOL	DOL		VIKTORIA RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC		VITO GARGANO		1535 RICHMOND AVE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC	*****3673	WALTERS AND WALTERS, INC.		465 EAST AND THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL		WAYNE LIVINGSTON JR	NORTH COUNTRY DRYWALL AND PAINT	23167 COUNTY ROUTE 59 DEXTER NY 13634	10/24/2016	10/24/2021
DOL	DOL	*****3296	WESTERN NEW YORK CONTRACTORS, INC.		3841 LAYNARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		WHITE PLAINS CARPENTRY CORP		442 ARMONK RD	06/12/2018	06/12/2023
DOL	DOL		WILLIAM C WATKINS		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		WILLIAM DEAK		C/O MADISON AVE CONSTR CO 39 PENNY STREETWEST ISLIP NY 11795	11/02/2016	11/02/2021
DOL	DOL	*****6195	WILSON BROTHER DRYWALL CONTRACTORS		36 ABERSOLD STREET ROCHESTER NY 14621	08/31/2015	08/31/2020
DOL	DOL	*****4043	WINDSHIELD INSTALLATION NETWORK, INC.		200 LATTA BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4730	XGD SYSTEMS, LLC	TDI GOLF	415 GLAGE AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DOL	*****7345	YES SERVICE AND REPAIRS CORPORATION		145 LODGE AVE HUNTINGTON STATION NY 11476	08/09/2016	08/09/2021
DOL	DOL		YURIY IVANIN		C/O MOUNTAIN'S AIR INC 2471 OCEAN AVENUE-STE 7ABROOKLYN NY 11229	09/24/2012	09/18/2020
DOL	NYC		ZAKIR NASEEM		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	NYC	*****8277	ZHN CONTRACTING CORP		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022



AGREEMENT made as of the                      day of                      in the year of Two Thousand                      .

BETWEEN the Owner  
(Name and address)

and the Contractor:  
(Name and address)

The Project is:  
(Name and location)

The Architect is:  
(Name and address)

The Construction Manager is:  
(Name and address)

The Owner and Contractor agree as set forth below.

**ARTICLE 1**  
**THE CONTRACT DOCUMENTS**

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, specifications, Addenda issued prior to execution of this Agreement, other documents listed in Article 9 of this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

**ARTICLE 2**  
**THE WORK OF THIS CONTRACT**

The Contractor shall execute the entire Work described in the Contract Documents or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

**ARTICLE 3**  
**DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION**

**3.1** The date of commencement of the work and substantial completion of the work of this contract shall be in accordance with the schedule set forth in the Project Manual.

**3.2** Time is of the essence respecting the contract documents and all obligations thereunder.

**3.3** Upon the execution of this Agreement, the Contractor shall provide the Owner with copies of all contracts entered into between the Contractor and subcontractors or material suppliers. The Contractor's obligation to provide the Owner with said contracts shall continue for the duration of the Project.

**ARTICLE 4**  
**CONTRACT SUM**

4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of \_\_\_\_\_, subject to additions and deductions as provided in the Contract Documents.

4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Bid Proposal Form (attached hereto) and are hereby accepted by the Owner:

4.3 Unit prices are as set forth in Exhibit A hereto.

## **ARTICLE 5**

### **PROGRESS PAYMENTS**

5.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

All progress payments shall be based upon an estimate and a certificate, made by the Architect, of the materials furnished, installed and suitably stored at the site and the work done by the Contractor, and payment shall be made in installments of ninety-five percent (95%) of the amount certified as earned so that, at the completion of the work, there will be a retainage of five percent (5%) of the Total Contract Sum. Retainage shall be paid to the Contractor upon final completion of the work of this contract. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

The Contractor shall submit with each application for payment the following:

1. A current Sworn Statement from the Contractor setting forth all subcontractors and materialmen with whom the Contractor has subcontracted, the amount of such subcontract, the amount requested for any subcontractor or materialman in the application for payment and the amount to be paid to the Contractor from such progress payment;

2. Commencing with the second (2nd) Application for Payment submitted by the Contractor, duly executed so-called "after the fact" waivers of mechanics' and materialmen's liens from all subcontractors, materialmen and, when appropriate, from lower tier subcontractors, establishing receipt of payment or satisfaction of payment of all amounts requested on behalf of such entities and disbursed prior to submittal by the Contractor of the current Application for Payment, plus sworn statements from all subcontractors, materialmen and, where appropriate, from lower tier subcontractors, covering all amounts described in this Paragraph 5.2;

3. Such other information, documentation and materials as the Owner or the Architect may require.

**5.3** Payment shall not be released to the Contractor until the Owner receives the following documentation:

1. Certified payroll for employees and employees of subcontractors performing work on the Project.

2. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.

## **ARTICLE 6**

### **FINAL PAYMENT**

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed including compliance with all provisions of the Contract Documents except for the Contractor's responsibility to correct nonconforming Work under Article 15(B) of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows or as soon thereafter as is practicable.

## **ARTICLE 7**

### **MISCELLANEOUS PROVISIONS**



7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

1. that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;

2. that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;

3. that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;

4. that its execution of this Agreement and its performance thereof is within its duly authorized powers;

5. that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contract Documents; and

6. that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity and nature of the particular Project, and that it will perform the Work with the care, skill and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All

representations and warranties set forth in this Agreement, including without limitation, this Paragraph 7.2, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

## **ARTICLE 8**

### **TERMINATION OR SUSPENSION**

**8.1** The Contract may be terminated by the Owner as provided in the General Conditions.

**8.2** The Work may be suspended by the Owner as provided in the General Conditions.

**ARTICLE 9**  
**ENUMERATION OF CONTRACT DOCUMENTS**

**9.1** The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

**9.1.1** The Agreement is this executed Agreement between Owner and Contractor.

**9.1.2** The General Conditions are the General Conditions of the Contract for Construction as set forth in the Project Manual and attached hereto.

**9.1.3** The Specifications are as set forth in the Project Manual and indexed in Exhibit "B" hereto.

**9.1.4** The Drawings are those as indexed in Exhibit "C" hereto.

**9.1.5** The Addenda, if any, are as follows:

Addendum No.	Date	Number of Pages
--------------	------	-----------------

**This Agreement is entered into as of the day and year first written above and is executed in at least three original copies of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.**

OWNER

CONTRACTOR

By \_\_\_\_\_  
(Signature) President

By \_\_\_\_\_  
(Signature) President

\_\_\_\_\_  
(Printed name and title)

\_\_\_\_\_  
(Printed name and title)



SECTION 006100 – BOND REQUIREMENTS  
See the conditions set forth in Article 11 of the General Conditions

- 1.01 The Contractor shall furnish separate performance and labor and material payment bonds each meeting per the requirements of Article 11 of the General Conditions and in an amount reflecting 100% of the entire amount of the construction contract.
- 1.02 The Contractor (s) shall include in his proposal amount the total premiums for the performance and labor and material payment bonds.





# AIA® Document A310™ – 2010

## Bid Bond

**CONTRACTOR:**

*(Name, legal status and address)*

**SURETY:**

*(Name, legal status and principal place of business)*

**OWNER:**

*(Name, legal status and address)*

**BOND AMOUNT: \$****PROJECT:**

*(Name, location or address, and Project number, if any)*

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Signed and sealed this    day of    ,

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Contractor as Principal)

\_\_\_\_\_  
(Seal)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Surety)

\_\_\_\_\_  
(Seal)

\_\_\_\_\_  
(Title)

Init.

/



## **Additions and Deletions Report for** **AIA<sup>®</sup> Document A310<sup>™</sup> – 2010**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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*There are no differences.*

## ***Certification of Document's Authenticity***

***AIA® Document D401™ – 2003***

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:07:52 ET on 03/05/2019 under Order No. 2513716516 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A310™ – 2010, Bid Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

\_\_\_\_\_  
*(Signed)*

\_\_\_\_\_  
*(Title)*

\_\_\_\_\_  
*(Dated)*



# AIA® Document A312™ – 2010

## Performance Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal place of business)

**OWNER:**

(Name, legal status and address)

**CONSTRUCTION CONTRACT**

Date:

Amount: \$

Description:

(Name and location)

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: ☐ None ☐ See Section 16

**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

(Any additional signatures appear on the last page of this Performance Bond.)

**SURETY**

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**
**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party:)

**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the

Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

**§ 8** If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

**§ 9** The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

**§ 10** The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

**§ 11** Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

**§ 12** Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

**§ 13** When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

#### **§ 14 Definitions**

**§ 14.1 Balance of the Contract Price.** The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

**§ 14.2 Construction Contract.** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

**§ 14.3 Contractor Default.** Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

**§ 14.4 Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

**§ 14.5 Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

**§ 15** If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_  
(Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

**SURETY**

Company: \_\_\_\_\_  
(Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

Init.

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## **Additions and Deletions Report for** **AIA® Document A312™ – 2010**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:03:53 ET on 03/05/2019.

*There are no differences.*

## ***Certification of Document's Authenticity***

***AIA® Document D401™ – 2003***

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:03:53 ET on 03/05/2019 under Order No. 2513716516 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Performance Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

\_\_\_\_\_  
*(Signed)*

\_\_\_\_\_  
*(Title)*

\_\_\_\_\_  
*(Dated)*





# AIA<sup>®</sup> Document A312<sup>™</sup> – 2010

## Payment Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal place of business)

**OWNER:**

(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

**CONSTRUCTION CONTRACT**

Date:

Amount: \$

Description:

(Name and location)

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: ☐ None ☐ See Section 18

**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

**SURETY**

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

Signature: \_\_\_\_\_

Name and

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party.)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

## § 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

**§ 16.4 Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

**§ 16.5 Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

**§ 17** If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

**§ 18** Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

**SURETY**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

## SECTION 006300 – REQUESTS FOR INFORMATION (RFI)

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Refer to Article 6 (T) of the General Conditions.
- B. This document is for issuance at the Post Bid/Pre-Construction Conference and specifies administrative and procedural requirements for handling requests for information (RFI's) made after award of Contract.
- C. Attention is directed to Sections 013300 and 013200 of Division #1 as same concerns construction progress schedules, submittals of shop drawings, samples and product data in general.

#### 1.02 SUBMITTALS PROCEDURES: RFI's shall be submitted in the following manner:

- A. One (1) completed copy of form following to Architect with copies to Owner (as directed) and appropriate Consultants with the following minimum information:
  - 1. Work identified by RFI listing affected Drawing(s) and specific detail(s) and Specification paragraph reference(s).
  - 2. Identify specific field conditions and "as-built" conditions on sketches attached to RFI submittal.
  - 3. If RFI addresses conflict(s) in, or between Contract Documents, describe completely and provide such data necessary to permit thorough and proper response by affected discipline.
  - 4. Indicate proposed solution along with any impacts on cost and construction time.
  - 5. Listing of Trade/Specialty Contractors affected by RFI and indication that RFI proposal has been coordinated with said contractors.

INCOMPLETE RFI'S WILL BE RETURNED TO CONTRACTOR WITHOUT ACTION TAKEN.

#### 1.03 REVIEW PROCEDURES/ACTIONS

- A. Architect/Engineer may request additional information or documentation as may be deemed necessary for fair evaluation of RFI.
- B. Architect/Engineer will respond with reasonable promptness as outlined in Section 013300 in writing and may, if deemed appropriate issue a "Bulletin" (as defined in the General Conditions) as a clarification to the Contract Documents.



# DRAFT AIA® Document G716™ – 2004

## Request for Information ("RFI")

TO:	FROM:	
PROJECT:	ISSUE DATE:	RFI No. 001
PROJECT NUMBERS: /	REQUESTED REPLY DATE: COPIES TO:	
RFI DESCRIPTION: <i>(Fully describe the question or type of information requested.)</i>		
REFERENCES/ATTACHMENTS: <i>(List specific documents researched when seeking the information requested.)</i>		
SPECIFICATIONS:	DRAWINGS:	OTHER:
SENDER'S RECOMMENDATION: <i>(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)</i>		
RECEIVER'S REPLY: <i>(Provide answer to RFI, including cost and/or schedule considerations.)</i>		
BY	DATE	COPIES TO

**Note:** This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.





**GENERAL CONDITIONS**  
*of the*  
**CONTRACT for CONSTRUCTION**

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## GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The within document includes detailed provisions concerning the capital improvement work to be performed by the Contractors engaged by the School District. This document contains provisions which relate particularly to capital improvement projects in the school district setting in New York State. The document is incorporated by reference into all contracts to be awarded and should be reviewed carefully by the Contractor to whom the award of contract is made. Consultation with an attorney and insurance representative is advised.

### ARTICLE 1 DEFINITIONS

- A. "Addendum" or "Addenda" refers to revised drawings and/or written requirements for the capital improvement work issued by the Architect prior to the time indicated for submission of a bid by a contractor.
- B. The "Architect" is the design professional engaged by the School District to perform design related functions respecting the capital improvement projects to be performed in the School District.
- C. "Board of Education" refers to the Board of Education of the School District.
- D. "Central Administration" refers to the Superintendent of Schools, his/her Assistant Superintendents, and Director of Plant & Facilities.
- E. The "Construction Manager" is the entity engaged by the School District to act as its representative during the course of construction of the Project.
- F. The "Contractor" refers to the entity engaged by the School District to perform all or a part of the capital improvement project on its behalf.
- G. The "Drawings" are the plans, elevations, sections, details, schedules and diagrams developed by the Architect for the capital improvement projects to be performed in accordance with the project manual of which these General Conditions of the Contract for Construction form a part.
- H. The "Project" refers to the entire capital improvement project to be performed in accordance with the project manual and may include work by the Owner.
- I. The "Project Manual" is the bound document which is issued simultaneously with the project Drawings and includes the Notice to Bidders, Information to Bidders, Bid Proposal Form, Prevailing Wage Rate schedule and the written requirements for labor, materials, equipment, construction systems and the like necessary for the Contractor to complete the capital improvement work for which it has been engaged.



J. The "Owner" refers to the School District, the Board of Education, its officers, agents and employees.

K. A "Subcontractor" is a person or entity who has a direct contract with the Contractor to provide material and/or labor for the project on or off the site, or to otherwise furnish labor, material or other services with respect to a portion of the Contractor's work. A "Sub-subcontractor" is a person or entity who has a direct or indirect contract with a Subcontractor engaged by the Contractor to perform a portion of the Subcontractor's work at the site, or to otherwise furnish labor, material or other services with respect to a portion of the Subcontractor's work.

L. The term "Specialist" or "Specialty Contractor" as used in these specifications shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workers skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

M. "Accepted", "directed" "permitted," "requested," "required," and "selected" mean, unless otherwise explained, "accepted by the Architect and/or Owner" "directed by the Architect and/or Owner," "permitted by the Architect and/or Owner," "requested by the Architect and/or Owner," "required by the Architect and/or Owner," and "selected by the Architect and/or Owner." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

N. "As accepted" "or acceptable substitute", and "for review" mean the Architect is the sole judge of the quality and suitability of the proposed substitutions. Where used in conjunction with the Architect's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning will be held to the limitations of the Architect's responsibilities and duties as stated in the General Conditions. In no case will "accepted by the Architect" be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

O. "Furnish" means supply and deliver to the Project site or other designated location, ready for unloading, unpacking, storing, assembly, installation, application, erection, or other form of incorporation into the Project, and maintained ready for use. Supply and deliver products requiring additional or supplemental fitting, assembly, fabrication, or incorporation into other elements of the Project directly to the fabricator, installer or manufacturer as required.

P. "Install" means unload, unpack, use, fit, attach, assemble, apply, place, anchor, erect, finish, cure, protect, clean, and similar operations required to properly incorporate work into the Project.

Q. "Provide" means furnish and install.



R. "Replace" means remove designated, damaged, rejected, defective, unacceptable, or non-conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.

S. The word "include", in any form other than "inclusive", is non-limiting and is not intended to mean all-inclusive.

## ARTICLE 2 CONTRACTOR'S REPRESENTATIONS

A. Upon submission of its bid to the Owner, the Contractor expressly represents:

1. The Contractor represents and warrants that it performed a detailed investigation of the site(s) and that such investigation was sufficient to disclose the conditions of the site(s) at which work is to be performed by it and all improvements thereon, and the conditions under which the work is to be performed, including, but not limited to (a) the location, condition, layout and nature of the project site and surrounding areas; (b) the cost of labor, materials and equipment necessary to perform the work, the availability; (c) the areas of the work which will cause a disruption to the necessary and proper operation of the facilities by the Owner; and (d) other pertinent limitations on the performance of its work.

2. The Contractor represents and warrants that it has carefully studied and compared the drawings and pertinent provisions of the project manual and that any errors, omissions, ambiguities, discrepancies or conflicts found in said documents have been brought to the attention of the Architect for clarification prior to the Contractor's submission of its bid. If, in the interpretation of Contract Documents, requirements within the Drawings and Specifications conflict, or it appears that the Drawings and Specifications are not in agreement, the requirement to be followed shall be decided by the Architect. Where there is a discrepancy in quantity, the Contractor shall provide the greater quantity; where there is a discrepancy in quality, the Contractor shall provide the superior quality. Addenda supersede the provisions that they amend.

3. Each contractor certifies that it is experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the work at various locations and orderly fashion and the completion of work at various locations and/or levels at various times. This "phasing", "out of sequence", or "come back" work shall be done at no cost to other contractors, the Owner, Architect or the Construction Manager.

B. The Contractor warrants to the Owner that (1) the materials and equipment furnished under its contract will be of good quality and new, and of recent manufacture, unless otherwise required or permitted by the Contract Documents, (2) that its work will be free from defects not inherent in the quality required or permitted, and (3) that its work will conform with the terms



and conditions of its agreement with the Owner. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective and shall be removed and replaced at the Contractor's cost and expense. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

C. Except as to any reported errors, inconsistencies or omissions, and to concealed or unknown conditions, by executing the Agreement, the Contractor represents the following:

1. The drawings and accompanying specifications found in the project manual issued simultaneously with said drawings are sufficiently complete and detailed for the Contractor to (a) perform the work required to produce the results intended by the Owner and (b) comply with all the requirements of its contract with the Owner.

2. The work required to be performed by the Contractor including, without limitation, all construction details, construction means, methods, procedures and techniques necessary to perform its work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (a) good and prevailing and accepted industry standards applicable to its work; (b) requirements of any warranties applicable to its work; and (c) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of its work.

3. The Drawings and Specifications for the Contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. Work under all items in the Contract must be carried out to meet field conditions to the satisfaction of the Architect and Owner and in accordance with his instructions and the Contract Drawings and Specifications.

4. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to insure proper and accurate fit of materials and items to be installed.

D. The representations set forth herein shall survive expiration and/or termination of the Contractor's agreement with the Owner.

### ARTICLE 3 CONTRACTOR'S CONSTRUCTION PROCEDURES

A. 1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures required for the proper execution of its work on the project. Where the drawings and/or project manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's work, such reference is intended only to indicate that the Contractor's work is to produce at least the quality of the work implied by the operations described, but the actual determination as to whether or not the described operations



may be safely or suitably employed in the performance of the Contractor's work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective work arising from the employment of a specific construction means, method, technique, sequence or procedure shall be borne solely by the Contractor.

2. Neither the Architect, the Construction Manager or the Owner will have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided herein.

3. The Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, rigging, water, heat, utilities, light, transportation, and other facilities and services necessary for proper execution and completion of its work, whether temporary or permanent and whether or not incorporated or to be incorporated in its work.

B. The Contractor shall be responsible for coordinating the work of its own forces and the work of subcontractors engaged by it to perform the work of the project on its behalf. The Contractor shall supply to its own work forces, and subcontractors engaged by it to perform portions of its work, copies of the drawings and project manuals for the work to be performed by such individuals/entities on its behalf. The Contractor shall review any specified or installation procedure with its employees and/or subcontractors, including those recommended by any product manufacturer, prior to the commencement of the relevant portion of the work to be performed. The Contractor shall be responsible to the Owner for the acts and/or omissions of the Contractor's employees, the Contractor's Subcontractors, the Contractor's material suppliers, and/or their respective agents and employees, and any other persons performing portions of the work on behalf of the Contractor.

C. The Contractor shall be responsible for the inspection of portions of the project performed by its own work force and/or subcontractors engaged by it for the purpose of determining that said work is in proper condition to receive subsequent work.

D. The Contractor shall perform its work in accordance with the standards of the construction industry applicable to work in the locale in which work is to be performed.

E. The Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously with all trades, crafts and any other individuals associated with the capital improvement work to be performed. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the project for any reason by anyone employed or engaged by the Contractor to perform its portion of the work. There shall be no lockout at the project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the work under any circumstance. Should it become necessary to create a separate entrance for a contractor involved in a labor dispute, all costs associated with creating that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.



F. 1. If the Contractor has engaged the services of workers and/or subcontractors who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect, the Construction Manager or the Owner, any conflict between its agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

2. In case the progress of the capital improvement work to be performed by the Contractor is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to its agreement with the Owner because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the capital improvement work pursuant to its contract.

3. The Contractor shall ensure that its work continues uninterrupted during the pendency of a labor dispute.

4. The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes.

G. The Contractor shall enforce strict discipline and good order among the Contractor's employees and its Subcontractors' work forces and other persons carrying out the performance of its work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Owner reserves the right to object to any person to be hired or who is employed by the Contractor. Upon the request of the Owner, said person shall be removed from the Project and not again be assigned to perform the Contractor's work without the written permission of the Owner.

H. Within one (1) week after a Notice to Proceed is received, the Contractor shall employ a competent, full-time Project Manager and On Site Superintendent to be approved by the Owner or its representative, and such necessary assistants who shall be in attendance at each project site whenever and wherever work is in progress to provide for the expeditious completion of the work. Said Project Manager and On Site Superintendent shall be employed until punchlist and closeout of the Project. To the extent work is being performed contemporaneously at different facilities within the School District, the Contractor shall assign different superintendents for each facility at which work is being performed. The Project Manager and On Site Superintendent assigned by the Contractor shall not be changed except with the consent of Owner, unless the Project Manager or On Site superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and On Site Superintendent shall represent the Contractor, and communications given to the Project Manager or On Site Superintendent, whether verbal or written, shall be as binding as if given to the Contractor. Oral communications to the superintendent(s) or his/her assistant(s) and/or project manager shall be confirmed in writing by the Owner or Architect. The Contractor shall forward to the Owner a



copy of the resumes for each of its superintendents, project managers and their assistants. The Owner, the Construction Manager or the Architect shall have the right to have any supervisory or management staff removed from the project with or without cause.

I. Each Contractor shall provide, or otherwise see that, the project manager, or on site superintendent site managers, and/or responsible workers of each Contractor and major subcontractor are equipped with cellular phones and radios. Each Contractor shall provide the Owner, the Construction Manager and the Architect with the number for each phone and worker.

J. The Contractor's supervisory personnel, including superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, superintendents and/or their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter to facilitate communications with such supervisory personnel, superintendents and/or assistants.

K. Prior to the commencement of work, the Contractor shall provide the Construction Manager and the Architect with:

1. a written list of the names, addresses and telephone numbers of the members of its organization who can be contacted in the event of an off-hours emergency at the building site, including cellular telephone numbers and personal/home telephone numbers.
2. a written list of subcontractors, sub-subcontractors, suppliers and vendors with names, addresses, telephone numbers, and descriptions of the work they shall perform or furnish.
3. The name, address and telephone number of the bonding company, banking and insurance company for the Prime Contractor employed by the Prime Contractor including the name, address and telephone number of each bonding company's primary contact representative for this project.
4. Detailed subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing and man loading.
5. A cash flow projection for the life of the project, including a schedule and graph showing the amount of work projected to be completed each month or billing period and a dollar value for the anticipated billings each month or billing period. This shall be completed after an agreed upon schedule of values has been approved by the Construction Manager.

L. 1. Tests, inspections and approvals of portions of the Contractor's work required by the drawings and/or specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to the Contract



Documents and, after consulting with the Architect and Construction Manager, the Construction Manager shall advise the Owner to make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority. The Owner shall bear all costs associated with the tests, inspections or approvals required by the drawings and/or specifications except as set forth in subparagraph 3 hereof.

2. Tests, inspections and approval of portions of the Contractor's work required by laws, ordinances, rules, regulations or orders of public authorities or governmental agency having jurisdiction shall be made at an appropriate time. The Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to law, ordinance, regulation or orders of public authorities or governmental agencies and shall advise the Owner in writing that it has made arrangements for such tests, inspections and approvals with the appropriate public authority or governmental agency. The Contractor shall be solely responsible for making timely notice of the need for a test, inspection and/or approval with the relevant public authority or governmental agencies and shall bear all costs associated with such testing, inspection or approval required by such public authority or governmental agency.

3. If the Architect, the Construction Manager, the Owner, or public authorities or governmental agencies having jurisdiction determine that portions of the Contractor's work require additional testing, inspection or approval due to the Contractor's failure to perform its work in accordance with the requirements of the Contract Documents and/or laws, ordinances, rules, regulations or orders of public authorities or governmental agencies having jurisdiction, the Architect and the Construction Manager will advise the Owner of the need for such additional inspections or tests and the Owner shall make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner. The Contractor shall bear the costs of such additional testing as provided in Article 14.

M. The Contractor shall, if required by ordinances, laws, codes, rules and/or regulations of the governing agencies having jurisdiction over this project, retain a licensed professional engineer to supervise the construction of this project including, but not limited to, foundations, structural work, soils, welding, reinforced masonry and the like.

N. The Contractor recognizes and acknowledges that the within project is governed by and subject to the provisions of New York State General Municipal Law, section 101, governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other contractors will be performing work on the project in conjunction with it. As such the Contractor agrees to cooperate with such other contractors performing work on the project and shall perform its work as follows:

1. The Contractor shall not interfere with the erection, installation or storage upon the premises of any work, materials, supplies or equipment which is to be performed and furnished by other contractors, and the Contractor shall properly connect and coordinate its work therewith.



2. The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other contractor performing work on the project. If the Contractor sustains any damage through any act or omission of other contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a subcontractor of such contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage.

3. The Contractor agrees to defend and indemnify Owner, Architect, Construction Manager, its Consultants and Sub-consultants, from all claims made against any of them arising out of Contractor's acts or omissions or the acts or omissions of any subcontractor of the Contractor which have caused damage to the Owner, Architect, Construction Manager or other contractor(s) on the project. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the contract or by law. Further, the Owner shall withhold from an offending contractor's contract sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

4. When the work of the Contractor or its subcontractors overlap or dovetail with that of other Contractors, materials shall be delivered and operations conducted to carry on the work continuously, in an efficient, workmanlike manner.

5. In case of interference between the operations of different Contractors, the Construction Manager will be the sole judge of the rights of each Contractor and shall have the authority to decide in what manner the work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

6. The Contractor, including its subcontractors, shall keep itself informed of the progress of other contractors and shall notify the Architect or the Construction Manager immediately in writing of lack of progress on the part of other contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's own work.

7. Delays or oversights on the part of any contractor or subcontractor in getting any or all of their work done in the proper way, thereby causing cutting, removing and replacing work already in place, shall not be the basis for a claim for extra compensation.

8. If part of the Contractor's work depends for proper execution or results upon construction or operations by the Owner or another contractor, the Contractor shall, prior to proceeding with that portion of its work, promptly report to the Architect and Construction Manager apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall



constitute an acknowledgment that the Owner's or other contractor's completed or partially completed construction is fit and proper to receive the Contractor's work.

9. The Contractor shall promptly correct discrepancies or defects in its work which have been identified by other contractors as affecting proper execution and results of the work of such other Contractor.

O. 1. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities or governmental agencies bearing on performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (a) the Owner, its consultants, employees, officers and agents, (b) the Architect and its consultants, employees, officers and agents, and/or (c) the Construction Manager and its consultants, employees, officers and agents against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder.

2. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation. If the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification to the drawings and/or specifications.

3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect, the Construction Manager and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs and shall bear the total cost for correction of same.

4. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation.

P. The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly unless otherwise designated by the Owner or the Architect. The Contractor shall have responsible representation at the MANDATORY weekly job meetings held at the Construction Manager's job office. These meetings will be held to arrange for satisfactory coordination of all trades on the project so as not to impede job progress. Contractors or subcontractors failing to attend job meetings shall be responsible for delays and/or expenses incurred due to coordination difficulty.



Q. The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including work activities on site and manpower. A "Daily Construction" form is included in these specifications and shall be used for reporting these activities. In addition, the Contractors are to submit a Two Week Look Ahead schedule for upcoming work. A "Two Week Look Ahead" form is included in these specifications for the Contractor's use.

#### ARTICLE 4 CONTRACTOR'S USE OF SITE

A. The Contractor shall confine operations at the site to the areas at which construction is to be performed and to such areas permitted by law, ordinances, permits and as set forth in detail in the project manual and drawings forming a part of its contract with the Owner.

B. Five (5) days after receipt of the Notice to Proceed, the Contractor shall provide two (2) copies of a video taped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all existing buildings, grounds, exterior conditions and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Contractor shall be responsible for paying the costs associated with any and all repairs in an area where the Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.

C. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

D. General Safety and Security Standards for Construction Projects:

1. All construction materials shall be stored in a safe and secure manner.
2. Fences around construction supplies or debris shall be maintained.
3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
5. The Contractor shall exert utmost care and diligence when working in or near any existing buildings or sitework. The absence of protection around such items shall not excuse the Contractor from its liability to provide protection. Any damage to existing buildings, sitework or facilities shall be repaired and charged to the Contractor responsible for the damage.



6. The Contractor shall be responsible for the removal and replacement of existing ceiling tiles and grid in areas of the existing building where its work is required and new ceilings are not scheduled for installation. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible contractor shall be liable for the costs of replacing in kind, the existing ceilings with new tile and grid.

7. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed after hours when the facility is not in use. The performance of this work shall be projected on all schedules required to be prepared by the Contractor. Additionally, the Contractor shall give the Construction Manager and the Owner at least forty-eight (48) hours advance notice of its intention to perform this type of work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Contractor performing the work.

E. 1. Separation of construction areas from occupied spaces: Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas. Methods of dust and fume control shall include, but not be limited to:

- a. Adequate ventilation;
- b. Wetting down;
- c. Keeping bags of insulating materials, cement, etc., closed.
- d. Controlled mixing of materials under field conditions;
- e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
- f. Job housekeeping must be maintained;
- g. Advising all personnel of hazardous conditions, including supervisors and workers;

Each contractor is responsible for instituting the above policies to insure minimal impact to surrounding occupied areas.



2. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

3. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

4. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

F. 1. Storage space will be allotted to the Contractor by the Owner to the extent such space, in the sole discretion of the Owner, is available. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. If insufficient space is available on the site, the Contractor shall provide local off-site storage, storage containers, etc. at its own cost and expense. Should any of the material stored on-site obstruct the progress of any portion of the work or the project, this material shall be removed by the Contractor without reimbursement of cost, from place to place or from the premises, as the Construction Manager may direct.

2. The Contractor shall schedule delivery of materials and equipment to minimize long term storage at the Project, to prevent overcrowding of construction spaces, and to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

3. The Contractor shall deliver materials and equipment to the Project in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installation. The Contractor shall inspect materials and equipment upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. The Contractor shall store products to allow for inspection and measurement of quantity or counting of units. The Contractor shall store materials in a manner that will not endanger the Project structure. The Contractor shall store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation. The Contractor shall comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

4. The Contractor shall not unreasonably encumber the site with materials or equipment during the performance of its work. Only materials and equipment which are to be used directly in the performance of the Contractor's work shall be brought to and stored on the premises of the School District. After equipment is no longer required for its work, the Contractor shall promptly remove such equipment from the premises of the School District. The Contractor



shall be solely responsible for the protection of construction materials and equipment stored on the premises from weather, theft, damage and all other adversity. The Contractor shall at all times provide the proper housekeeping to minimize potential fire hazards, and shall provide approved spark arresters on all steam engines, internal combustion engines and flues.

5. A construction entrance will be designated for deliveries. A separate entrance will be established for entering and exiting the site only. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner's Security department. Unexpected or uncoordinated deliveries may be turned away by the Owner or the Construction Manager at the discretion or necessity of the Owner. The Owner's enforcement of this provision shall not be construed by any contractor or subcontractor as the basis for a claim of delay in time or monetary damages alleged to have been incurred as a result of refusal of delivery.

6. The Contractor for General Construction shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The Contractor for General Construction shall submit its means and methods of security to the Construction Manager for review and comment. The project site(s) must be secured 24 hours a day, 7 days a week including holidays. The General Construction Contractor's failure to secure the site as required by this paragraph will result in the Owner engaging the services of such necessary personnel so as to provide such security. No notice will be given the Contractor for General Construction of the Owner's intention to engage such security services and all costs and expenses associated with the Owner's security of the site in this regard will be back charged to the Contractor for General Construction. While the Owner may have security guards patrolling the project areas, the function of such security guards is not for the purpose of specifically guarding the Contractor's property or operations of work.

G. The Contractor's right to entry and use of the School District premises arises solely from the permission granted by the Owner pursuant to the agreement between the Contractor and the Owner. This permission shall be deemed to be withdrawn upon the termination of the Contractor's agreement with the Owner.

H. 1. The Contractor shall be required to perform its work with no interruption to the School District's operations, including its administrative and business operations. Any work which will interfere with the School District's operations and/or which is to be performed when the School District's facilities are in operation shall be performed on evenings and weekends. Additionally, the Contractor shall conduct its work in compliance with federal, state, county or local ordinances. All costs incurred by the Owner to make the facilities available during evening and weekends shall be borne by the Contractor. The Owner reserves the right to determine what work will "interfere" with its operations and said determination shall be final.

2. The Contractor may request access to the site during times beyond the work hours permitted. Approval is solely at the discretion of the Owner. If approval is given, the Contractor is responsible for paying all additional costs incurred by the Owner, Architect and the Construction Manager for providing the site to the Contractor during the additional time periods.



3. In the event the Contractor fails to complete all work under this contract by said scheduled dates, the Contractor will not be permitted to perform any work during normal school hours. Such work shall only be performed after school hours, Saturdays, Sundays, holidays or periods when school is unoccupied at no additional cost of any kind to the Owner. In addition to damages incurred by the Owner in connection with the Contractor's delay, the Contractor shall be liable for all costs incurred by the Owner to provide staff, Architect and Construction Manager personnel as required to make facility accessible by Contractor and perform inspections during such off hours.

4. The Owner shall not be responsible for any overtime charges incurred by the Contractor during the course of this project. Any and all costs associated with work which is performed at hours requiring the payment of such overtime by the Contractor to its workers shall be the Contractor's responsibility.

I. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.

J. The Contractor shall provide all required temporary access walkways, both interior and exterior, and the like necessary to complete its work. The Contractor shall maintain an unobstructed condition at all entrances and/or exits from present buildings. No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement, UNLESS THE CONTRACTOR HAS OBTAINED THE PRIOR APPROVAL OF THE CONSTRUCTION MANAGER AND THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE CONSTRUCTION MANAGER.

K. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the premises of the School District without the prior written consent of the Owner, which consent may be withheld at the sole discretion of the Owner.

L. 1. Without the prior approval of the Owner, the Contractor shall not permit any workers to use any existing School District facilities, including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Employees, vehicles, and equipment of the Contractor and of all others engaged by the Contractor for the performance of its work shall enter onto the premises of the School District for which construction work is to be performed only at those locations designated or approved by the Construction Manager. The parking for construction personnel shall be limited to the designated trailer park area only. Failure to abide by this rule will result in towing of cars at the expense of the contractor who employs the individual.

2. The Contractor shall ensure that its work, at all times, is performed in a manner that affords reasonable access to both vehicles and individuals, to the premises of the School District and all adjacent areas. The Contractors' work shall be performed, to the fullest extent possible, in such a manner that areas in and around the construction area shall be free from all debris, building materials and equipment likely to cause hazardous conditions, and do not close



or obstruct walkways, roadways or other occupied facilities or facilities to be used by the Owner. Without limitation to any other provision of the agreement between the Contractor and the Owner, the Contractor shall use its best efforts to minimize any interference with the occupancy of areas, buildings, entrances, and parking areas in and around the premises at which work is being performed. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site.

3. The Construction Manager, in conjunction with the Owner and the Architect, shall designate locations at the site at which the Contractor, its subcontractors and employees may utilize in connection with its work. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from trespassing or leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and other engaged by the Contractor to perform its work are restricted to the immediate area at which work is to be performed. Only persons having official business will be admitted to the construction site. NO COMMUNICATION BETWEEN THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS' EMPLOYEES, OR OTHERS ENGAGED BY THE CONTRACTOR FOR THE PERFORMANCE OF ITS WORK AND STUDENTS OR STAFF WILL BE PERMITTED.

4. The Contractor, its employees, its Subcontractors and their employees or agents, and all others engaged by the Contractor in connection with the performance of its work are required to wear photographic identification badges at all times. The Contractor shall provide such individuals with said photographic identification badges. These badges shall be worn so as to be readily and easily visible. All workers and representatives of the Contractor, its subcontractors or suppliers shall wear these badges while on school property. The information on these badges shall be as prescribed by the Owner and the Construction Manager. Each person seen without a photo identification badge (or otherwise failing to comply with this requirement in the opinion of the Owner or the Construction Manager) shall be ordered to leave school property. No warnings shall be necessary. The Contractor(s) and their subcontractor(s) employing the offending person(s) shall be solely responsible for making-up and paying for any loss of production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor). All parties agree that any action taken to enforce this requirement shall not be construed by any Contractor or its subcontractors or suppliers as the basis for a claim (for either time or money) for delay to the Work or to the Contractor, its Subcontractors, or Suppliers.

5. Without limitation of any other provision of the agreement between the Owner and Contractor, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the premises of the School District. The Contractor shall immediately notify the Owner in writing if during the performance of its work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternative through which the same results intended by such portion of the rules and regulations



can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations.

M. No drinking of alcoholic beverages, smoking or use of controlled substances is permitted on the grounds. The Contractor shall insure that none of its or its Subcontractors, its employees, agents, and/or consultants report to the site impaired by alcohol or controlled substances. The Contractor bears the responsibility of determining if its, or its subcontractors, employees are in any way impaired and whether the safety of the public, the employees of other Contractors and their Subcontractors, the Owner, Architect, or Construction Manager are jeopardized. Each contractor shall provide drinking water for its own employees.

N. The Contractor's employees, representatives, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to refrain from using indecent language. All doing so will be removed from the site. Artwork or decoration found on vehicles belonging to Contractor or Subcontractor employees parked on or near the school property which contain indecent language or pictures shall either be covered or removed from the location.

O. The Contractor's employees, representative, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to wear shirts, long pants and proper footwear.

P. Each contractor shall keep the premises and surrounding area in which it is working free from accumulation of waste materials or rubbish caused by the performance of all of the work being performed on-site and in the buildings. On a daily basis at the conclusion of work on the project, each contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery and surplus materials. Each Contractor shall broom sweep all construction areas in which it has performed worked every day. The Construction Manager shall perform an inspection each afternoon to determine that the work areas of the contractors have been properly cleaned. In the event the work areas are not cleaned, the Construction Manager shall advise the offending contractor to provide cleaning as required herein. If any contractor fails to keep the site safe and clean within four (4) hours of being notified by the Construction Manager, either verbally or in writing, the Construction Manager will have the clean up work performed and back charged to the offending contractor without further notification to the Contractor. The cost of such cleaning company, together with the cost of any custodial costs of the School District, at prevailing overtime rates plus 15% will be charged to the offending contractor. Notice to field personnel shall be deemed notice to the Contractor.

Q. The Contractor shall provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out and to prevent excessive humidity, moisture and condensation. Ventilation shall be by natural or artificial means as required by conditions involved.



R. The Contractor shall be responsible for the control of chemical fumes, gases and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure that they do not enter occupied portions of the building or air intakes.

S. The Contractor shall be responsible for ensuring that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers' recommendations before a space can be occupied.

T. From the commencement to the completion of the Project, the Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of water.

U. 1. The General Contractor shall construct temporary partitions where shown on drawings or where otherwise required for safety of the public or to prevent dust from entering occupied areas. Partitions shall be dust-proof from floor to slab or structure above (if existing condition is a drop in tile ceiling, Contractor shall remove tile and install partition to structure above). In addition to framing and sheetrock, the Contractor shall install fire resistant plastic partitions on the work area side of its work. If an access door is required, an alternating 3 layer plastic system shall be used. The door shall be a standard hollow metal door with lockset and closer. Keys shall be distributed to the Owner's other contractors, the Owner and the Architect.

2. All cutting and welding performed within an occupied building or adjacent to a window or intake vent shall be performed during off hours.

V. 1. The Contractor shall control the safe handling and storage of all welding materials, acetylene and oxygen tanks, and other equipment required for welding and cutting work at the job site. Such storage shall be in compliance with OSHA regulations.

2. Welding materials and equipment shall be removed promptly from the premises upon completion of the welding and cutting work.

W. The Contractor shall be responsible for all costs incurred by the Owner caused by false security/fire alarms set off by the Contractor. Costs shall include custodial response charges etc.

X. The Contractor shall be responsible for broken glass, and at the completion of the Work shall replace such damaged or broken glass. After damaged or broken glass has been replaced, the Contractor shall remove all labels, wash and polish both sides of all glass. In addition to general broom cleaning, the General Contractor shall perform the following final cleaning for all trades at completion of the Work:

1. Remove temporary protections;
2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and natural finished woodwork and other Work;



3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
5. Clean aluminum in accordance with recommendations of the manufacturer; and
6. Clean all floors thoroughly in accordance with recommendations of the manufacturer.

Y. Where a contractor other than the General Contractor is the only contractor engaged to perform work, the responsibilities allocated to the General Contractor in these General Conditions shall be performed by such other contractor.

## ARTICLE 5 SUBCONTRACTORS

A. 1. As soon as practicable after receipt of Letter of Intent to Award, Notice to Proceed or other form of official notice of award of the Contract, but not more than ten (10) days after receipt of official notice of award of the Contract, the Contractor shall furnish the Owner and the Architect, in writing, with (1) the name, trade and subcontract amount for each Subcontractor and (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Copies of all Subcontractor contracts, fully executed, are to be provided to the Construction Manager, including but not limited to all addenda, appendices, and/or exhibits including scope of work sheets. All such subcontracts shall be submitted to the Construction Manager within ten (10) days of the Owner's award of the contract to the Contractor.

2. Upon review of the Contractor's list of Subcontractors, the Architect will advise the Contractor in writing stating whether or not the Owner, the Construction Manager or the Architect, after due investigation, accepts or rejects, any proposed Subcontractor. Subcontractors will not be acceptable unless, when requested by the Architect, evidence is furnished that the proposed subcontractor has satisfactorily completed similar subcontracts as contemplated under this prime contract, and has the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract in accordance with the intent to the Documents. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years worth of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

3. If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager and Architect have no objection. No increase in the Contract Sum shall be allowed where a sub-contractor is rejected by the Architect, Construction Manager or Owner who is (1) deemed unqualified to perform the particular work subcontracted by the Contractor, (2) does not have the necessary experience, personnel, equipment, plant and financial ability to complete the subcontract, or (3) has a history of poor performance in work of similar



nature. Upon receipt of a rejection of a subcontractor by the Architect, the Contractor shall have the right to request a meeting with the Architect, Construction Manager and the Owner to discuss the reasons it believes the subcontractor is qualified to perform the work. Upon review of such reasons, the Architect shall re-consider its determination and shall advise the Contractor of its determination upon such review. If the Architect still finds that such subcontractor does not meet the requirements above-stated, it shall advise the Contractor. The Architect's determination upon such review shall be final and binding on the Contractor and its Subcontractor and the Contractor hereby waives any and all claims it or its subcontractor might have against the Owner, the Construction Manager and/or the Architect concerning the rejection of such Contractor and shall require its subcontractors to execute such similar waiver in its agreement with the Contractor.

4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

B. By appropriate agreement, the Contractor shall require each Subcontractor to be bound to the Contractor by terms of the Contractor's agreement with the Owner, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by said agreement, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contractor's agreement with the Owner so that subcontracting thereof will not prejudice such rights, and shall allow the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by its agreement with the Owner, has against the Owner. However, the Subcontract agreement between the Contractor and Subcontractor shall not provide, nor shall this Agreement be deemed to provide any rights, remedies or redress by the Subcontractor(s) against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors.

C. The Contractor shall promptly notify the Owner, Construction Manager and Architect of any material defaults by any Subcontractors and/or whether it has terminated its agreement with any of its subcontractors for any reason.

D. The Contractor hereby assigns all of its rights in its agreements with its Subcontractor(s) and hereby does assign, transfer and set over to the Owner all of its rights and/or interests in its agreements with its Subcontractor(s), but only in the event of termination of the Contractor's agreement with the Owner pursuant to Article 17, paragraph A of these General Conditions of the Contract for Construction and only to the extent the Owner implements its rights to take such assignment of contract by notifying the Subcontractor in writing of its intention to do so. Such an assignment is subject to the prior rights of the surety, if any, obligated to the Owner pursuant to a performance bond submitted in connection with the Contractor's work.

E. If the Work in connection with a subcontract has been suspended for more than ninety (90) days after termination of the Contract by the Owner and the Owner accepts assignment of



such subcontract, the Subcontractor's compensation shall not be adjusted for any increase in direct costs incurred by such Subcontractor as a result of the suspension.

F. It shall be the Contractor's responsibility, when sub-contracting any portion of his work, to arrange or group items of work under particular trades to conform with then prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work is described.

G. All subcontracts must be in writing.

## ARTICLE 6 CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS

A. The Agreement between the Owner and Contractor, and all documents incorporated therein by reference, including but not limited to, the drawings and project manual shall be signed by the Contractor and the Owner.

B. The intent of the agreement between the Owner and the Contractor is to include all items necessary for the proper execution and completion of the work to be performed by the Contractor. The documents comprising the agreement between the Contractor and the Owner are complementary, and what is required by one shall be as binding as if required by all.

C. 1. In the event of inconsistencies within or between parts of the agreement between the Contractor and the Owner or between the agreement between the Contractor and the Owner and applicable standards, codes and ordinances, the Contractor shall (a) provide the better quality or greater quantity of Work or (b) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation.

2. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings.

3. Before ordering any materials or performing any of its work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the performance of the work.

4. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

5. Drawings, in general, are made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job and in no case by scaling. The Contractor shall study and compare all Drawings and verify all figures before laying out or



constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing is obtained from the Architect.

6. In the event addendum (a) are issued and contain changes to the Drawings and/or Specifications, the provisions in the addendum (a) supersede previously issued Drawings and/or Specifications.

D. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control Contractor in dividing the work among Subcontractor or in establishing the extent of Work to be performed by any trade.

E. Unless otherwise stated in the agreement, words and abbreviations which have well-known technical or construction industry meanings are used in the agreements in accordance with such recognized meanings.

F. The Contractor, and all Subcontractors, shall refer to all of the Drawings, including those showing the work of others performing work in connection with the project, including but not limited to the General Contractor (if any), the Plumbing Contractor, the Heating, Ventilation, Air Conditioning Contractor, Electrical Contractor and other specialized trades, and to all of the Divisions of the Project Manual, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.

G. All indications or notations on the drawings which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the drawings or project manual. All work mentioned or indicated in the drawings or project manual shall be performed by the Contractor unless it is specifically indicated therein that the work is to be performed by others.

H. The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Contractor's work is to be performed. The Contractor may retain one contract record set during the course of the project. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work.

I. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects without the specific written consent of the Owner and Architect. The



Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the performance of its work pursuant to its agreement with the Owner. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

J. The Owner shall furnish surveys describing physical characteristics of the site, upon written request of the Contractor and to the extent such survey is in existence at the time of said request, legal limitations and utility locations for the project sites. Nothing herein shall be construed as requiring the Owner to generate any document which it does not possess at the time of the request by the Contractor. In the event that the survey provided does not clearly delineate the metes and bounds of the Owner's property, the Contractor shall stop work and immediately notify the Architect, Construction Manager and the Owner. The Contractor shall NOT proceed with its work until it receives written permission from the Construction Manager and/or the Architect. The Contractor shall be fully responsible for all costs arising from non-compliance with this provision. Any delays associated with this provision shall not serve as a basis for a claim by the Contractor.

K. From the basic data established by the Owner, the General Contractor shall establish reference control points and complete the layout of the work. Each Contractor is responsible for utility markouts as it pertains to the scope of their work and maintain markout during work. Sketch of layout with reference points to be given to Construction Manager and Architect at the time of markout.

L. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of the Architect to meet changed conditions.

M. The General Contractor shall be responsible for the establishment of points, wall and partition lines required by the various Prime Contractors and subcontractors in laying out their work.

N. Each Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the base lines and bench marks established by the Owner.

O. 1. The General Construction Contractor shall establish a baseline and benchmark system for each building addition, area of renovation or component using the services of a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall have not less than five years of experience in performing construction surveys similar to the work they will perform



for this project. The remaining Contractors and their respective subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layout for their own work. The Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. The Contractor and its subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by another contractor or subcontractor shall be immediately reported to the Construction Manager. If any corrections are necessary, they shall be executed in accordance with the terms and provisions of these General Conditions.

2. The Contractor and its subcontractors shall be responsible to offset or to protect their markings from anything that may disturb them.

3. Every contractor shall work off the lines and elevations established and maintained as the baseline and benchmark system.

4. Each Contractor is responsible for the accuracy of his own work.

P. The Architect may require that construction work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed work or the work in progress.

Q. Except for the basic building permit, the Contractor shall be responsible for securing and maintaining for the life of the project: all permits, P.E. Licenses, connection fees, inspections, etc. applicable to, or customarily secured for the work. This provision includes any permits to be issued in the name of the Contractor required for the work. Originals of all permits are to be issued in the name of the Contractor as required for the work. The Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the work, and shall prominently display a copy of all permits at a location approved by the Construction Manager.

R. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

S. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contracts, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, utilities and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.



T. 1. The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define its work in greater detail, or to permit the proper progress of its work. To the extent the Architect advises the Contractor that the existing design drawings, specifications and/or instructions given are sufficiently detailed for the Contractor to perform its work, the Architect shall be under no obligation to further clarify or define the work to be performed. In all other circumstances, the Architect shall issue a field order which responds to the request for information.

2. Requests for Information (RFIs) are for requests on clarifications or questions on contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, as a means to describe or request approval of alternate construction means, methods or concepts or substitution of materials, systems means and methods. The Contractor shall fill all RFIs out in accordance with the provisions of the Project Manual. Neither the Architect nor the Construction Manager shall fill said forms out on the Contractor's behalf.

U. The Contractor shall, prior to the start of any portion of the Work:

1. review any specified construction or installation procedures, including those as may be recommended by the proposed manufacturer.
2. advise the Architect if the specified procedure(s) deviates from good construction practice.
3. advise the Architect if following said procedure(s) will affect any warranty, including the contractor's general warranty.
4. advise the Architect of any objections the Contractor may have to the specified procedure(s).
5. propose any alternative procedure(s) which the Contractor will warrant.

V. 1. To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

2. The Contractor is responsible for providing products and construction methods



compatible with products and construction methods of other contractors. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

3. With respect to sitework materials, all products submitted for use and incorporated into this project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

4. All products submitted for use and incorporated into this project shall be asbestos free.

W. Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the contractor desires to use any kind type, brand, or manufacturer or material other than those named in the specifications, they shall indicate in writing, and prior to award of contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for substitutions as set forth in Article 6.X below.

X. 1. Substitutions. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall indicate the desired substitution in its bid, including the following:

a. For which specified material or equipment the request for substitution is being made;

b. What kind, type, brand, or manufacturer is sought to be substituted for the specified items;

c. Written documentation evidencing that the substituted material or equipment meets or exceeds the specifications for materials and/or equipment set forth in the project manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, significant qualities of proposed substitution (e.g. performance, weight, size, durability and visual effects), and other like information necessary for a complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. All such data shall be provided to the Architect and Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the project in the event the substitution is acceptable. Additionally, the Contractor shall submit to the Architect information describing in specific detail how the proposed substituted product differs from the

quality and performance required by the base specifications, and such other information as may be required by the Owner or the Architect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

e. Samples, where applicable or requested.

f. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

g. Detailed comparison of the difference in cost between the specified product and the proposed substitution including any and all costs associated with changes or modifications needed to other parts of the work and to construction performed by the Owner and/or separate Contractors that will be necessary to accommodate proposed substitution. In the event the substitution is accepted, the Contractor proposing the use of the substitution shall bear all costs associated with said changes or modifications.

2. By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

a. Represents that a representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified.

b. Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product.

c. Certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the architect and engineers to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent.

d. Represents that it will coordinate the installation of the accepted substitute, making all such changes to the drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and ventilating specifications as may be required for the work to be complete in all respects.



- e. An affidavit stating that (1) the proposed substitution conforms and meets all the requirements of the pertinent Specifications and the requirements shown on the Drawings and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the construction schedule.
  3. Proposals for substitutions shall be submitted with the Contractor's bid.
  4. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.
- Y. 1. Submittal of shop drawings, product data, material safety data sheets, samples or similar submittals shall be in accordance with the provisions of the project manual.
2. The Contractor represents and warrants that all shop drawings have been prepared by persons and entities possessing expertise and experience in the trade for which the shop drawing is prepared and, if required by the Architect or applicable law, by a licensed engineer, job specific, reviewed by Contractor and stamped by the Contractor.
  3. If the Contractor elects to perform its work without approvals, such work shall be at the Contractor's own risk and expense.
  4. By approving and submitting shop drawings, product data, samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of its work.
  5. The Contractor shall not be relieved of responsibility for deviations from requirements of its work by the Architect's approval of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors and/or omissions in the shop drawings, product data, samples or other of its submittals to the Architect, by the Architect's approval thereof.
  6. The Architect shall review, approve, reject or take other appropriate action respecting submittals made by the Contractor as set forth in the Project Manual. The Architect shall check for conformance with information given in the drawings and project manual and the design concept expressed in the agreement between the Owner and the Contractor. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems designed by the Contractor, all of which remain the responsibility of the Contractor. Further, the Architect's review shall not constitute



approval of safety precautions or, unless otherwise specifically stated by the Architect, of construction means, methods, techniques, sequences or procedures.

The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon such certification to establish that the materials, systems or equipment will meet the performance criteria required by the Contract Documents.

7. Upon the Architect's rejection of the Contractor's shop drawings, product data, samples and/or other documentation submitted by the Contractor to the Architect, the Contractor shall review the rejection and re-submit such shop drawing, product data, sample and or other document in accordance with the Architect's instruction. The Contractor shall direct the Architect's specific attention in writing or on re-submitted shop drawings, product data, samples, or similar submittals, to revision which have been made, including revisions not specifically requested by the Architect. Resubmission of rejected documents shall be performed within ten (10) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

8. When professional certification of performance criteria of materials, systems or equipment is required of the Contractor, the Architect shall be entitled to rely in a reasonable and professional fashion upon the accuracy and completeness of such calculations and certifications provided, however, if the Architect, in its reasonable and professional judgment considers it advisable, the Architect shall verify the accuracy and completeness of any and all such calculations and/or certifications. In the event any and all such calculations and/or certifications are found to be inaccurate and/or incomplete by the Architect, the Contractor shall assume full responsibility and bear all costs attributable or related thereto, including, without limitation, the expense of the Architect's additional services associated with the verification of such calculations and/or certifications and the expense of the Architect's additional service made necessary by the failure of such calculations and/or certifications to be accurate or complete.

9. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review as set forth in the Project Manual.

Z. The Architect will interpret and decide matters concerning performance under and requirements of the drawings and/or technical specifications on written request of the Contractor. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Contractor's work. Such drawings or instructions may be forwarded by the Architect to the Contractor by field order, construction change directive or other notice to the Contractor. The Contractor shall execute the work for which it requested an interpretation in accordance with such additional drawings or instructions without additional cost or extension of its contract time. After a decision has been rendered by the Architect on a matter for which the Contractor sought the Architect's interpretation of the drawings and/or technical specifications, the Contractor shall proceed with the work as directed by the Architect. Failure to proceed with the work in



accordance with the Architect's interpretation may be used as a basis for termination of the Contractor's contract pursuant to Article 17 of these General Conditions.

AA. The Contractor shall maintain at the site one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and the Construction Manager and shall be delivered to the Construction Manager for submittal to the Owner upon the completion of its work.

BB. The Contractor shall maintain at the site, and shall make available to the Owner, Construction Manager and Architect, one record copy of the Drawings (the "Record Drawings") in good order. The Record Drawings shall be prepared and updated during the prosecution of the Contractor's work. The prints for Record Drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural and/or structural changes in the design; and (vi) such other information as either Owner or Architect may reasonably request. At the completion of the work, Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower right hand corner. The colored record drawing and the as-built reproducible drawing shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to Contractor until the Record and/or As Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

CC. The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies. All approved drawings shall be wrapped, marked and delivered to the Owner within sixty (60) days of final completion of the Contractor's work.

DD. Each Prime Contractor shall be furnished, free of charge, 3 copies of the Contract Documents and Project Manuals, including all Addenda. Any and all additional copies will be furnished to the Contractor at the cost of reproduction, postage and handling.

## ARTICLE 7 CONTRACTOR'S SAFETY/SECURITY PROGRAM

A. 1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of its work.



Prior to beginning any work, the contractor shall submit a copy of its corporate safety plan to the Owner and the Construction Manager. Two (2) weeks after receipt of the Notice to Proceed, the Contractor shall provide a Site Safety/Logistics Plan to the Construction Manager. The site logistics plan should minimally include locations of the eight-foot high temporary fence and gates, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radius, and lift locations, stockpiles, toilet locations, site water and power locations, and safety. This plan shall also show the location of all staging and storage areas, clearly separating construction and school areas. The logistical information represented by the construction documents shall serve as a minimal guide. Each contractor is required to submit their corporate safety policy within ten (10) days of receipt of the Notice to Proceed. Said policy must minimally meet OSHA standards and define details concerning the maintenance of a safe work environment. The Contractor shall make the participation of its subcontractors in its safety program mandatory. A list of key personnel, with addresses and telephone numbers for emergency purposes shall be forwarded to the Construction Manager and Architect. The Owner and the Construction Manager shall establish a fire coordination procedure and shall forward same to the Contractor for its use during the performance of its work.

2. All laborers, workers, and mechanics employed in the performance of the work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration.

The Contractor and its subcontractors shall conduct their operation in accordance with the Safety Guides for Construction as issued by the SED, and, the Contractors' Safety Program.

3. All safety equipment including hard hats and weather protective gear required for the Contractor to perform its work are to be supplied by the Contractor and/or its subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its subcontractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the project. No prior warnings will be given by the Owner or Construction Manager and Architect. The Contractor and its subcontractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

4. The Contractor and its subcontractors shall provide blankets and auxiliary fire protection as part of its construction safety program to prevent damage to adjacent work or materials as a result of its welding or burning operations. Additionally, as part of its construction safety program, the Contractor and its subcontractors shall provide a fire watch, with a fire extinguisher, which is acceptable to the Owner and the Construction Manager.

5. The Construction Manager and/or Owner reserve the right to have all operating equipment periodically inspected by an independent inspector whose finding will be binding.



The Prime Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report.

6. All flagmen required for deliveries to the site are to be furnished by the Contractor or its Subcontractors responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests.

B. The Contractor shall schedule weekly safety meetings and each of its subcontractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. The Contractor shall notify the Construction Manager in writing its "OSHA Competent Person Regarding Safety". Said person must be an individual capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Construction Manager and Architect. The Contractor shall take all necessary steps to prevent its employees from disturbing and/or damaging the facility and shall be responsible for preventing the escape of fires set in connection with the construction. The Contractor shall notify its employees and subcontractors of the location of the nearest fire alarm box at all locations where the work is in progress. On a weekly basis, the Contractor shall submit to the Construction Manager and Architect minutes of its safety meetings, which minutes shall include a list of the individuals present at such meetings.

C. The Contractor and each of its subcontractors shall conduct its/their operation in accordance with all applicable laws, regulations and order of local, state and federal governments. The Contractor agrees, in order that the work will be completed with the greatest degree of safety to conform to the requirements of the Occupational Safety and Health Act of 1970 (OSHA) and the Construction Safety Act of 1969, including all standards and regulations that have been since or shall be promulgated by the governmental authorities which administer such acts.

D. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

E. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for surety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

F. The Contractor shall take reasonable precautions for the safety and protection of employees at the project site and other person who may be affected by its work, including but not limited to students, staff, employees and agents of the Owner, the Construction Manager and the Architect.



G. The Contractor shall protect and secure its work and the materials and/or equipment to be utilized in connection with its work, whether stored on or off the site and whether in its care, custody and control or that of its Subcontractors, subcontractors to its subcontractors, or material suppliers.

H. The Contractor shall take all steps necessary to protect all property at or adjacent to the site, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

I. All delivery vehicles/trucks/machinery/etc. permitted on the site must be equipped with back-up alarms and enter through the designated access points. The Contractor's failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the contractor responsible for the work involved.

J. All crane picks, materials delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to insure the safety of the building occupants. Crane location must approved by the Construction Manager to insure the safety of building occupants.

K. The Owner or Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Contractor, at its own expense, must make corrections cited by the inspector before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. The Contractor and/or its subcontractor(s) shall cooperate with the inspector by allowing time for the inspection. The Contractor shall be notified twenty four (24) hours prior to the time of the inspection. These inspections do not release the Contractor if its responsibility to provide all engineering, permits and inspections as required by OSHA or the New York State Education Department prior to use of any hoisting equipment.

L. The Contractor shall use the entrances designated on the site logistic plans and drawings for personal vehicles, trucks, equipment, deliveries and the like.

M. All interior temporary partitions and emergency egress barriers (if required) are to be installed on an after hours basis (weekends/school holidays).

N. 1. When use or storage of hazardous materials or equipment or unusual construction methods are necessary to perform its Work, the Contractor shall obtain the Owner and the Construction Manager's consent for the use of such materials, equipment or unusual construction methods. In the event the Owner determines that the use of such hazardous material or equipment or unusual construction methods can be performed by the Contractor with alternative means, methods and/or techniques, the Contractor shall employ such alternate means of prosecuting its work at no additional cost to the Owner.



2. In the event the Owner approves the use or storage of such hazardous materials, equipment or unusual construction methods, the Contractor shall provide for the Owner's and the Construction Manager's use a full set of safety instructions relating to all such materials. Additionally, when the Owner and/or the Construction Manager reviews the use of storage of such hazardous materials, equipment and or unusual construction methods, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

3. Transportation, storage, and use of explosives shall be in strict accordance with all local, state and federal regulations, statutes, and requirements. All safety precautions as set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc. shall be observed.

4. The Contractor is responsible for its own storage and personnel trailers at the site. The Contractor will be required to supply man trailers and storage box trailers as required. All costs related to delivery, construction, protection, power, etc. for said trailers are the responsibility of the contractor utilizing the space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of personnel and/or storage trailer will be strictly limited to pre-determined locations. The Contractor shall obtain the written approval of the placement of any trailer or storage box from the Construction Manager.

O. During construction, the General Contractor shall be responsible for maintaining a watertight structure. This shall include additions and existing buildings. The contractor shall be responsible for temporary roofing, tarps and other protection at roofs, cavity walls, etc. Should the contractor fail to provide adequate protection, causing flooding, damage or other disturbance to the existing building, contractor shall be responsible for all costs associated with clean up and repairs. Inasmuch as flooding and damage have safety implications to the general public, clean up and repairs may be made by the Owner without warning to the Contractor. Administration costs incurred by the Owner and Architect will also be back charged to the Contractor. The Contractor, by entering into contract with the Owner agrees to be liable for these costs.

P. When all or a portion of the Contractor's work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the work, as necessary, from injury by any cause.

Q. 1. The Contractor shall promptly remedy damage and loss to all property of the Owner, or adjacent to the Owner's property (other than damage or loss covered by insurance) caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

2. Title to all completed or partially completed work at the job site, and to all materials delivered to and stored at said job site which are intended to become a part of the



completed work covered by the agreement between the Contractor and the Owner, shall be in the name of the Owner. Notwithstanding the foregoing, and prior to acceptance of the completed work by the Owner, the Contractor shall be liable for all loss of or damage to said completed work, partially completed work, materials furnished by the Contractor, and/or materials or equipment furnished by others, the custody of which has been given to the Contractor, arising from any cause other than those against which the Owner herein undertakes to carry insurance. In the event of loss or damage from cause other than those against which the Owner undertakes to carry insurance, the Contractor shall replace or repair the said work or materials at his own cost and expense, to the complete satisfaction of the Owner, the Construction Manager and the Architect.

R. The Contractor shall promptly report in writing to the Owner, the Architect and the Construction Manager all accidents arising out of or in connection with the Work which cause death, person injury, or property damage, giving full details and statements or any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager and the Architect.

S. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss.

T. Any and all fines or citations levied against the Owner, Architect, or Construction Manager due to the failure of the Contractor to comply with regulations of any governing authority, shall be paid for by the Contractor. This shall include any interest or late charges which accrue due to the Contractor's failure to remit payment upon receipt of such levies.

U. The Contractor shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly employed by such Contractor, with respect to violations of OSHA requirements, rules and/or regulations.

V. The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, and to the extent permitted by law, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract.

W. The Contractor shall indemnify and hold harmless the Owner, Architect, and Construction Manager, of and from any and all liability for violation of such laws and regulations and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the



Contractor shall be liable to the Owner for all costs of the Owner, Architect or Construction Manager in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

X. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly employed by such Contractor, for the act and/or omissions of any Contractor or Subcontractor that resulted in an incident and/or accident causing personal injury and/or property damage.

Y. The Construction Manager, the Owner, and/or the Architect will not assume any responsibility for the safe operation of any cranes or equipment by exercising this right. The Contractor and its subcontractors shall cooperate with the inspector by allowing time for inspection. The Contractor will be notified 24 hours prior to the time of the actual inspection. The Contractor is obligated to perform all engineering, obtain permits, and to have all hoisting equipment inspected as required by OSHA, Village, Town, County, State, and Federal regulations as well as any other agency having jurisdiction. Copies of all inspection reports and certificates must be transmitted to Construction Manager as soon as possible.

## ARTICLE 8 CHANGES IN THE WORK

A. Without invalidating the agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.

B. Field Orders are an interpretation of the contract drawings and/or specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contractor's total contract sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of time of the Contractor's time to complete its work. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its work and/or the work of other contractors engaged by the Owner in connection with the project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

C. 1. When the Owner or Architect (in association with the Construction Manager) request that the Contractor perform work which is not included in the contract drawings or specifications and which will result in additional cost to the Owner, the Architect/Construction Manager shall issue a PCO Number and shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and Architect for review. The Contractor's proposal shall include a complete itemization



of the costs associated with performing its work including labor and materials. All proposals for any work that a Contractor, its subcontractor(s) or subcontractor(s) of subcontractor(s) perform in connection with additional work shall be submitted using the following format and in no event shall the total for overhead and profit on any change order exceed fifteen percent (15%) of the cost of the work.

1.	Materials (Itemized Breakdown) including quantities and cost	
2.	Labor (Itemized Breakdown)	
3.	Subtotal (Add lines 1 and 2)	
4.	Credit for work not required due to additional or changes to the work reflected in the within change order (if any)	
5.	Overhead (10% x line 3)	
6.	Subtotal (Add lines 3 through 5)	
7.	Sub-Contract Work (Include itemized breakdown. Sub-Contractor(s) overhead and profit allowed is 10%)	
8.	Subtotal (Add lines 6 and 7)	
9.	Profit (5% x line 8)	
10.	Subtotal (Add lines 8 and 9)	
11.	Rental Value of Equipment (Itemized Breakdown)	
12.	Actual additional charges for bonds	
13.	TOTAL CHANGE ORDER (Add lines 10, 11 and 12)	

2. All proposals submitted by the Contractor without the itemization indicated herein will be returned to the Contractor for re-submission by the Contractor. For any work performed by the Contractor's own forces, fifteen percent (15%) for overhead and profit will be allowed for labor and material related costs. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall any change order proposal exceed fifteen percent (15%) of the cost of overhead and profit.

The Contractor shall not be entitled to recover overhead and profit on the rental value of equipment and machinery. "Equipment and machinery" shall not include (1) tools customarily used by the contractor's trade, including but not limited to hand tools, and/or (2) equipment and machinery already on site and being utilized by the Contractor for the original scope of work.

The Contractor shall submit with its change order proposals actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds.

3. The Contractor's subcontractor's proposal for any work it is to perform in connection with the additional work shall only include ten percent (10%) for the subcontractor's overhead and profit including sub-subcontracted work. The Contractor is entitled to five percent (5%) on work performed by its subcontractor in accordance with paragraph C (1) of this Article 8. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall the Contractor or the Contractor's subcontractor(s) be entitled to be reimbursed for overtime, except when specifically approved by



the Owner in writing and not as an Extraordinary Measure as set forth in Article 13, and in such event the Contractor shall be paid for by the Owner on the basis of premium payment.

4. Notwithstanding the foregoing, work which is performed pursuant to an allowance included in the Contractor's base contract, the provisions of Article 9, paragraph B, concerning itemization of such work shall be controlling.

5. a. A change in the Contract Sum shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim as defined in Article 18 of these General Conditions to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. **No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.**

b. Upon the Contractor's completion of the change order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

1. Certified payrolls itemizing the labor actually utilized in connection with the change order work.
2. Copies of invoices from subcontractors supplying work in connection with the change order work.

D. 1. When the Owner or Architect request that portions of the Contractor's work originally included in the contract drawings or specifications be deleted and which will result in a reduction of the Contractor's original contract sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such work from its contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such work including labor and materials and shall be submitted using the format set forth in Article 8, paragraph C(1) of these General Conditions of the Contract for Construction or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and/or profit for such work nor shall any of its subcontractors which were to perform the work being deducted from the Contractor's scope of work. Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase/decrease with respect to that change.

2. The Owner may in its sole discretion deduct and/or reduce the scope of the Contractor's contract with or without any specific reasons therefor.



E. 1. In the event the Contractor and the Owner cannot agree on the sum by which its contract with the Owner is to be increased or reduced based upon changes to the scope of the work as described in Article 8, the Architect shall issue a construction change directive reflecting the deduction and/or reduction of the scope of the Contractor's contract and the Contractor will (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the work of this or other contractors working at the site, and (b) in the case of work to be deducted from the scope of the Contractor's work, refrain from taking any steps in connection with the work associated with the deduction and/or reduction of the scope of the Contractor's work. The construction change directive shall include (a) a description of the work being added or deducted from the Contractor's scope of work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction and/or reduction of the scope of the Contractor's contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's contract sum, or until a claim filed by the Contractor has been determined; (c) the extent to which the contract time will be adjusted as a result of the change in the scope of work. Any claims must be filed in accordance with the requirements set forth in Article 18 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

2. In the event the Contractor and the Owner reach agreement on the amount by which the Contractor's contract sum is to be increased or decreased based upon changes to the scope of the Contractor's work as described in Article 8, the Architect, Owner, Construction Manager and Contractor shall sign a change order reflecting such agreement. The change order shall include (a) the description of the change in the scope of the Contractor's work; (b) the amount of the adjustment to the Contractor's contract sum, if any; and (c) the length of time by which the time to complete the contract will be adjusted, if any. Agreement between the Owner and the Contractor in connection with any change order shall constitute a final settlement of all matters relating to the change in the Contractor's work as reflected in said change order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contractor's contract sum and the construction schedule. All such change orders for which the Owner and the Contractor have reached agreement shall be included as a separate line item in the Contractor's applications for payment as if originally part of the Contractor's agreement with the Owner.

F. Neither the Owner, the Construction Manager nor Architect may issue instructions to the Contractor to change the amount of the Contract, except by properly executed Change Orders. Instructions are issued by the Owner or the Construction Manager through the Architect, to the Contractor. The instructions shall not be carried out by the Contractor prior to a written order in the form of a Change Order, signed by the Owner, Architect and Contractor, authorizing a change in the Contract amount or an adjustment to the Contract Sum. No amount shall be payable by the Owner to the Contractor for performance of work without an executed Change Order.



## ARTICLE 9 PAYMENTS

A. 1. Prior to commencing its work on the project and within one (1) week of receipt of a Notice to Proceed, the Contractor shall submit to the Construction Manager and the Architect, a schedule of values which includes the amount of money it has allocated in its bid price for the following items of work which are applicable to the Contractor's work. Said schedule of values shall include each of the CSI division sections reflected in the specifications and applicable to the contract for which the Contractor has been awarded the contract, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least two (2) percent of the contract sum), shop drawing/product data/sample submissions (at least one (1) percent of contract sum), labor and materials on line items as applicable, temporary utilities and services, HVAC balance reports, coordination drawings, punchlist (at least one (1) percent of the contract sum), warranties/guarantees and close out of the project (at least three (3) percent of the contract sum), and allowance, where applicable.

2. Any schedule of values which fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or Architect to be improper for any reason, sufficient funds shall be withheld from the Contractors' future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's work.

3. The schedule of values shall be drafted so as to reflect multiple construction sites, multiple locations within each site, additions versus renovations of work, and the like so as to satisfy any New York State Education Department requirements for the project.

4. The Schedule of Values prepared by the Contractor must be approved by the Construction Manager and the Architect prior to the payment of any sums due the Contractor.

B. The Contractor shall include in its contract sum all allowances stated in the specifications. However, the Contractor's costs for unloading and handling at the site, overhead, profit and other expenses contemplated for the stated allowance amounts shall be included in its contract sum and not in the allowances.

C. The Contractor shall submit its applications for payment to the Construction Manager and the Architect on a periodic basis. The form to be used by the Contractor shall be AIA 702/CMA and 703/CMA approved by the Construction Manager, the Architect and the Owner for use in connection with the Contractor's work. The form shall be divided in sufficiently in the same form as the Contractor's schedule of values and shall reflect in separate line items for the work:

1. Total value of the work listing labor and material separately
2. Percentage of work completed at the time of submission of the application for payment



3. Value of the work completed at the time of submission of the application for payment
4. Percent of previous amount billed
5. Previous amount billed
6. Current percent completed;
7. Value of work completed to date
8. Percent remaining to be completed by the Contractor; and
9. Value of work remaining to be completed by the Contractor

D. 1. Payments to the Contractor shall be based upon materials and equipment delivered and suitably stored at the site and/or incorporated into the Contractor's work, together with the labor utilized by the Contractor in connection with its work. The Contractor may be paid for materials and/or equipment which has been delivered to the Owner's facilities but which, at the time of submission of its application for payment, has not yet been incorporated into the Contractor's work upon such conditions and requirements as the Owner, the Construction Manager and/or the Architect may advise the Contractor it must satisfy.

2. The Construction Manager and Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager and/or the Architect may make such adjustments under the following circumstances:

- a. the Contractor's failure to remedy defective work;
- b. the filing of third party claims or reasonable evidence that there is a probability that such claims will be filed;
- c. receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the project;
- d. the Contractor's failure to make proper payments to its subcontractors or material suppliers for labor, materials and/or equipment;
- e. reasonable evidence that the Contractor will not complete its work for the unpaid balance of the remaining monies on its contract;
- f. damages caused to the Owner, Construction Manager, the Architect or another contractor as a result of the Contractor's performance of its work;
- g. reasonable evidence that the Contractor will not complete its work in accordance with its agreement with the Owner, and/or that the remaining monies available on the Contractor's contract will not be sufficient to cover actual or liquidated damages for the anticipated delay;

- h. the Contractor's failure to carry out its work in accordance with the contract drawings and/or specifications;
  - i. the Contractor's failure to notify the Architect of errors or inconsistencies between and among the contract drawings and specifications;
  - j. the Contractor's and/or its subcontractors' failure to comply with the requirements for maintaining record drawings;
  - k. the Architect's and/or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective and/or incomplete;
  - l. such other acts and/or omissions by the Contractor in connection with the performance of its work.
  - m. The amount requested exceeds the percent completion of work on the site.
3. After any such adjustments are made to the Contractor's application for payment, the Contractor shall submit four (4) copies of the final draft of its application for payment to the Construction Manager and Architect, which shall be accompanied by the following documentation:
- a. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material suppliers in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;
  - b. Duly executed waivers of public improvement liens from all Subcontractors and material suppliers and lower tiered Subcontractors or material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and AIA Form G706 or G706A.
  - c. Certified payroll for employees of the Contractor and employees of subcontractors performing work on the Project.
  - d. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.



- e. Such other information which the Owner, Construction Manager and/or the Architect request the Contractor furnish in connection with its application for payment, including but not limited to, contractor change order log, contractor submittal log and as built drawings to date.
- 4. Upon submission of its application for payment, the Contractor represents that it is entitled to payment in the amount for which it seeks payment.
- 5. In addition to the right to make adjustments to the amount the Contractor claims is due it (as set forth in paragraph 3 of this paragraph (2), the Owner may withhold payment from the Contractor and the Architect and/or Construction Manager may withhold certification for payment, if any of the reasons set forth in paragraph 3 exist.
- 6. The Owner shall make payment to the Contractor within forty-five days of receipt of the Contractor's requisition of payment unless such requisition of payment is not in accordance with the terms of the Construction Documents.
- 7. Upon receipt of payment by the Owner, the Contractor shall promptly make payment to each of its subcontractors and/or material suppliers for which it has received payment from the Owner. This provision does not obligate the Architect, the Construction Manager and/or the Owner to ensure payment to the Contractor's subcontractors and/or material suppliers.
- 8. a. In the event a subcontractor and/or material supplier files with the Owner a public improvement lien, the Owner shall withhold payment on previously certified applications for payment which have not yet been paid or subsequent applications for payment submitted by the Contractor an amount equal to 150% of the amount set forth in such public improvement lien. This provision is in addition to and does not supersede the indemnity provisions set forth in Article 12 of these General Conditions.
- b. The Owner may release any payment withheld due to the filing of a public improvement lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less the 150% of such lien claim. The cost of the premiums for any such bond posted shall be borne solely by the Contractor. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of its obligations pursuant to these General Conditions, including but not limited to the indemnity provisions set forth in Article 12 of these General Conditions.
- E. 1. The Contractor shall not be entitled to payment for materials and/or equipment stored off the site unless previously approved in writing by the Owner, Architect, and/or the Construction Manager and upon the Contractor meeting any and all conditions which the Owner,

the Architect and/or Construction Manager may impose in connection with such materials and/or equipment, including but not limited to insurance for such materials and cost of storage and transportation associated with such materials and/or equipment. No payment will be made for "commodity type" stored materials such as block, studs, sheetrock, roofing, insulation, piping, fittings, conduit work, etc.

2. In connection with materials and/or equipment stored off the project site, the Contractor must submit with its application for payment the following information:

- a. Type of material must be specifically identified by the Contractor;
- b. The Contractor must furnish an invoice from its supplier showing the total value of material and/or equipment being stored off site and must provide the bill of lading for such material and/or equipment;
- c. The Contractor must provide a Certificate of Insurance in a form approved by the Owner for the full value of the item plus 10%.
- d. The Contractor must execute a security agreement, together with an executed UCC-1 form;
- e. The materials must be stored in a bonded warehouse;
- f. The Contractor must furnish a bill of sale for stored material and/or equipment;

Contractor still has liability for all materials whether paid or not until installed.

3. Any and all materials and/or equipment for which the Contractor has been paid shall be titled in the Owner upon installation by the Contractor and shall be stored in a bonded facility. For payment to be made to the Contractor, the Contractor must provide the Owner with a waiver of lien and general release from its supplier in connection with its provisions of such materials and/or equipment. Notwithstanding payment by the Owner, any and all warranties and/or guarantees required by this agreement shall not begin to run until the Contractor has completed all of its work.

4. Prior to payment by the Owner, the Contractor may be required to provide the Architect and the Construction Manager with an opportunity to visually inspect the materials and/or equipment for the purpose of determining that such materials are in fact in storage, are the materials specified for the Contractor's work and for any other purpose which the Owner, Construction Manager and/or Architect deem necessary for payment to be made to the Contractor.



F. If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to its agreement with the Owner, including but not limited to these General Conditions of the Contract for Construction, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contractor's contract sum by an amount equal to that which the Owner is entitled.

G. The Contractor may not assign any monies due or to become due to it pursuant to its agreement with the Owner without the Owner's written consent. Any such assignment shall be in a form acceptable to the Owner. If the Contractor attempts to make such an assignment without such consent from the Owner, the Contractor shall nevertheless remain legally responsible for all obligations under its agreement with the Owner.

H. Progress payments and all other payments shall be made in accordance with Section 106 (b) of the General Municipal Law.

I. At the same time the Contractor submits its insurance certificate to the Owner and the Construction Manager, it shall also submit to the Construction Manager the labor rates of each category of labor for which it and/or its subcontractors shall employ (either directly or indirectly).

This information shall be itemized in the format shown below:

Contractor's Name					
Contractor's Address					
Contractor's Office Phone					
Contractor's Fax Number					
Contractor's Email Address					
Labor Rate Breakdown					
Worker's Title		Journeyman	1.5 Rate	Foreman	1.5 Rate
Base Hourly Rate					
Payroll Tax & Insurance:	\$ Per Hr.				
FICA					
Federal Unemployment					
State					
Workers Compensation					



Disability					
Other (Explanation Required)					
<b>Subtotal</b>					
<b>Benefits:</b>	<b>\$ Per Hr</b>				
Vacation					
Health & Welfare					
Pension					
Annuity					
401K Fund					
Other (Explanation Required)					
Other Explanation Required)					
<b>Subtotal</b>					
<b>Hourly Labor Rate</b>					

## ARTICLE 10 INSURANCE REQUIREMENTS

A. Within ten (10) days of the award of the bid, the Contractor, at its sole cost and expense, shall provide the Owner with the following insurance coverage whether the operations to be covered thereby are through the Contractor or by a Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Workers' Compensation and Disability:

Coverage	Statutory
Extensions	Voluntary compensation All states coverage employers Employer's liability - unlimited

2. Commercial General and Umbrella Liability

Coverage	Occurrence using ISO occurrence Form CG 00 01 07 98 or later form
Limits per project	General Aggregate - \$2,000,000.00 on a per project basis  Products/Completed Operations - \$2,000,000.00

Personal & Advertising Injury - \$1,000,000.00

Fire Damage (any one fire) - \$100,000.00

Medical Expenses (any one person) - \$10,000.00

3. Owners and Contractors Protective Liability Insurance:

- a. \$2,000,000 per occurrence, \$4,000,000 general aggregate for contracts greater than \$1,000,000, or any contracts involving scaffolds or work above a height of one story.
- b. \$1,000,000 per occurrence, \$2,000,000 general aggregate for contracts less than or equal to \$1,000,000 that do not involve scaffolds or work above a height of one story.

Excess Liability (excess coverage shall be on a follow-form basis):

- a. \$10,000,000 for contracts greater than \$1,000,000, or any contracts involving scaffolds or work above a height of one story
- b. \$5,000,000 for contracts less than or equal to \$1,000,000 that do not involve scaffolds or work above a height of one story.

4. Automobile Liability  
(all vehicles hired  
or non hired)

\$1,000,000.00 per accident

5. If this project requires the removal of asbestos and/or hazardous materials, Contractors shall provide hazardous material liability insurance as follows:

\$2,000,000 per occurrence/\$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract. If motor vehicles are used for transporting hazardous materials, the Contractor shall provide pollution



liability broadened coverage (ISO endorsement CA 9948), as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years following acceptance by the District of the Certificate of Completion.

6. Testing Company Errors and Omission Insurance

\$1,000,000 per occurrence/\$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.

Notwithstanding any terms, conditions or provisions, in any other writing between the parties, Contractor hereby agrees to effectuate the naming of the Owner, Architect and Construction Manager as an additional insured on the Contractor's commercial general liability and excess liability insurance policies. If the policy is written on a claims-made basis, the retroactive date must precede the date of the contract.

- a. The policy naming the Owner, Architect and Construction Manager as an additional insured shall:
  - i. Be an insurance policy from an A.M. Best rated "Secure" insurer, licensed in New York State.
  - ii. State that the coverage shall be primary and non-contributory coverage for the District, its Board, employees and volunteers.
- b. The Owner, Architect, and Construction Manager shall be listed as an additional insured by using endorsement CG 2038 or equivalent. The decision to accept an alternative endorsement rests solely with the Owner. A completed copy of the endorsement must be attached to the certificate of insurance.
- c. The certificate of insurance must describe the work that is covered by the liability policies.
- d. At the Owner's request, the Contractor shall provide a copy of the declaration page of the liability and excess policies with a list of endorsements and forms. If so requested, the Contractor will provide a copy of the policy endorsements and forms.
- e. The Contractor agrees to indemnify the Owner, Architect and Construction Manager for any applicable deductibles and self-insured retentions.

If written on a "claims-made" basis, the retroactive date must pre-date the inception of the Contract or agreement. Coverage shall remain in effect for two years following the completion of work. The testing company shall also provide proof of Workers' Compensation and NY State Disability Benefits Insurance, Commercial General Liability and Excess Liability with limits of \$2,000,000 each occurrence and in the aggregate.



Coverages shall be maintained without interruption from the date of commencement of the work until the date of final payment and termination of any coverage required to be maintained after final payment.

B. Article 10 of the General Conditions shall remain in effect and the Contractor will be required to provide the insurance set for therein. The Contractor will be permitted to commence work on the Project with the insurance certificates currently on file with the Owner. On or before July 15 of each year, the Contractor will substitute said insurance certificates with insurance in strict compliance with Article 10. In addition to any other rights or remedies that the Owner may have in law, equity or pursuant to the General Conditions of Construction set forth in the Agreement between the Owner and the Contractor, in the event the Contractor fails to provide evidence of the insurance required by Article 10 by July 15, the Owner shall assess liquidated damages of \$1,000 for every day the Contractor fails to meet the requirements for insurance as set forth in Article 10 through final completion of the Project or the date the required insurance is submitted, whichever is earlier.

C. The insurance required to be procured by the Contractor, pursuant to paragraph A of this Article 10, shall be purchased from and maintained by an insurance carrier licensed to do business in the State of New York, with an A.M. Best Rating of "secured" or better. The Contractor must submit the Certificate of Insurance to the Architect for the Owner's approval prior to the commencement of any work. **EXCESS OR SURPLUS LINE INSURANCE CARRIERS WILL NOT BE ACCEPTED.**

D. All insurance coverage to be provided by the Contractor, pursuant to paragraph A of this Article 10, shall include a cancellation notice to the Owner pursuant to the policy terms and conditions. All insurance coverage to be provided by the Contractor shall name the Owner, Architect, and Construction Manager as additional insureds on the policy, with the exception of Owners Contractors Policies. Additionally, the insurance coverage to be provided by the Contractor, pursuant to paragraph A of this Article 10, shall state that the Contractor's coverage shall be the primary and non-contributory coverage for the Contractor's work. Contractors shall include a completed copy of the ACORD 855 - NY Construction Certificate of Liability, with explanations of "yes" responses to Items G through L.

E. In the event that any of the insurance coverage to be provided by the Contractor to the Owner contains a deductible, or a self-insured retention, or the insurance provided by the Owner contains a deductible, the Contractor shall indemnify and hold the Owner, Construction Manager, and the Architect harmless from the payment of such deductible or self-insured retention, which deductible shall in all circumstances remain the sole obligation and expense of the Contractor.

F. The Contractor acknowledges that its failure to obtain or keep current the insurance coverage required by paragraph A of this Article 10 shall constitute a material breach of Contract and subjects the Contractor to liability for damages, including but not limited to direct, indirect, consequential, special and such other damages the Owner sustains as a result of such breach. In



addition, the Contractor shall be responsible for the indemnification to the Owner, Architect, and Construction Manager, of any and all costs associated with such lapse in coverage, including but not limited to reasonable attorney's fees.

G. The Contractor shall require all Subcontractors to carry insurance coverages and limits of liability, as set forth in paragraph A of this Article 10 and submit same to the Owner for approval prior to start of any work. In the event the Subcontractor is unable to provide insurance by a carrier that is licensed and admitted to do business in New York, the Owner reserves the right to accept Excess or Surplus lines insurance coverage for said Subcontractor, in the Owner's sole discretion. Notwithstanding the foregoing, the Owner is under no obligation to waive the requirement that the insurance be supplied by an insurer licensed and admitted in New York. In the event the Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the Owner, Construction Manager, the Architect, Engineers, Consultants, and Sub-consultants and their agents or employees from any and all claims for which the required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.

H. The Contractor assumes responsibility for all injury or destruction of the Contractor's materials, tools, machinery, equipment, appliances, shoring, scaffolding, false and form work, and personal property of the Contractor's employees from whatever cause arises. Any policy of insurance secured covering the Contractor or Subcontractors leased or hired by them and any policy of insurance covering the Contractor or Subcontractors against physical loss or damage to such property shall include an endorsement waiving the right of subrogation against the Owner for any loss or damage to such property.

I. The Owner in good faith may adjust and settle a loss with the Contractor's insurance carrier.

J. The Owner and the Contractor waive all rights against each other and any of their Subcontractors, Sub-subcontractors, agents and employees for damages caused by fire or other perils to the extent of actual recovery of any insurance proceeds under any property insurance policy procured, pursuant to paragraph A of this Article 10, or other property insurance applicable to the Contractor's work.

K. Before commencement of its work, the Contractor shall obtain and pay for such insurance as may be required to comply with the indemnification and hold harmless provisions outlined under Article 12 of these General Conditions of the Contract for Construction.

L. Review and acknowledgment of the Certificate of Insurance by the Owner or the Architect shall not relieve or decrease the liability of the Contractor hereunder.

M. If the terms of policies expire, or the lives of the insurance companies terminate, before the Contract is completed or during the period of completed operations coverage, and the



Contractor fails to maintain continuance of such insurance, the Owner is entitled to provide protection for itself, to pay premiums, and to charge the cost to the Contractor.

## ARTICLE 11 REQUIRED BONDS FOR THE PROJECT

- A. Within ten (10) days of the award of the bid, the Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the State of New York.
- B. All Surety companies are subject to the approval of the Owner and may be rejected by the Owner without cause.
- C. Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.
- D. Bonds shall be executed by a responsible surety licensed to do business in New York with an A.M. Best Rating of "A-" or better as to Policy Holder Ratings, and "VII" or better as to "Financial Size Category." Such bonds shall remain in effect for a period not less than two (2) years following final completion of the work by the Contractor.
- E. Bonds shall further be executed by a surety that is currently listed on the U.S. Treasury Department Circular 570 entitled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies," as amended.
- F. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to 100% of the Contract Sum. The value of each bond shall be adjusted during the Project construction period to reflect changes in the Contract Sum.
- G. Every Bond must display the Surety's Bond Number.
- H. Each bond must be accompanied by an original Power of Attorney, giving the names of Attorneys-in-fact, and the extent of their bonding capacity.
- I. A rider including the following provisions shall be attached to each Bond:
  - 1. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.
  - 2. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or



Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the Owner.

3. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within three years after termination by the Owner of the Contractor's contract or within three years after final completion by the Contractor. In the event the Contractor files for bankruptcy, the commencement of the three year period shall not start to run until the bankruptcy proceeding is finalized or the Owner obtains relief from an automatic stay, whichever is later.

J. The Contractor shall deliver the required bonds to the Owner prior to beginning construction activity at the site, but no later than 10 days of issue date of Notice of Award of Contract. Said bonds shall be in the form set forth in the Project Manual. No work shall be performed by the Contractor until such bonds have been reviewed and approved.

K. The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of the progress of the Contractor's work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Contractor's work.

L. If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of this Article, the Contractor shall within ten (10) days thereafter substitute another Performance and Payment Bond and surety, both of which must be acceptable to the Owner.

## ARTICLE 12 INDEMNIFICATION

A. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees, or agents from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses, including but not limited to attorneys' fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any of its subcontractors or any person or firm directly or indirectly employed by such Contractor, for the act(s) and/or omission(s) of any Contractor or Subcontractor in connection with the work of the Project.



B. To the fullest extent permitted by law, the Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees, or agents from and against claims, damages, losses and expenses including but not limited to attorneys' fees, arising out of or resulting from performance of its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph B shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices required by Article 6(T) of these General Conditions of the Contract for Construction.

D. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents against any actions, lawsuits or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's project funds, including all the cost and expense of said liens, and including but not limited to attorneys' fees incurred by each or any of them.

E. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and



agents, and any of their respective employees or agents of and from any and all liability for violation of any laws and regulations applicable to the Contractor's work and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

F. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents of and from any and all liability for claims made by third parties, including subcontractors, in connection with this Agreement and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

G. The indemnification obligations set forth herein shall become effective upon the Owner, Architect or Construction Manager's receipt of a claim for which the Contractor is required to provide indemnification to the Owner, Architect or Construction Manager. In the event the Owner, Architect or Construction Manager is required to bring an action to enforce the indemnification obligation, the Contractor shall be liable to the Owner, Architect, and/or Construction Manager for all costs associated with said action including attorneys' fees.

### ARTICLE 13 TIME FOR COMPLETION OF WORK

A. The date of commencement of the Contractor's work shall be as indicated in the agreement between the Contractor and the Owner. The date shall not be postponed or extended by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible to act. Time limits stated in the agreement between the Owner and the Contractor are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

B. The Contractor shall not commence work on the site until two certified copies of all insurance policies and bonds required by Article 10 and Article 11 of these General Conditions of the Contract for Construction are provided to the Owner and accepted by the Owner. The date of commencement and/or completion of the Contractor's work shall not be changed by the effective date of such insurance. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the acceptance of the insurance and bonds required by Article 10 and Article 11 of these General Conditions.

C. The Contractor shall proceed expeditiously with adequate forces and shall achieve substantial completion of its contract in accordance with the schedule set forth in its agreement.



The Contractor shall cooperate with the Owner, Architect, Construction Manager, and other Contractors on the Project, making every reasonable effort to reduce the contract time.

D. 1. In the event the Owner determines that the performance of the Contractor's work, as of a milestone date, has not progressed or reached the level of completion required by its contract, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities and (3) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the Contractor progresses its work in compliance with the stage of completion required by its agreement with the Owner. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

2. The Contractor shall not be entitled to an adjustment in its contract sum in connection with Extraordinary Measures ordered by the Owner under or pursuant to this Paragraph D.

3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph D as frequently as the Owner deems necessary to ensure that the Contractor's performance of its work will comply with any Milestone Date or completion date set forth in the Contractor's agreement with it.

4. The Owner reserves the right to withhold payment from the Contractor until such time as the Contractor submits a daily schedule showing work to be again on schedule with the Construction Schedule and/or until its work is being installed according to the project construction schedule, without additional cost to the Owner.

E. The Contractor shall achieve substantial completion of its work in accordance with the schedule for the work set forth in the project manual included as part of its agreement with the Owner. Milestone Dates are dates critical to the Owner's operations that establish when a part of the work is to commence or be complete. All Milestone Dates are of the essence and shall have the same meaning as Substantial Completion for the purpose of Liquidated Damages in this Article 13.

F. Substantial completion shall be achieved by the Contractor when the Contractor has completed ninety eight (98%) of its work. Work remaining to be completed after substantial completion shall be limited to items which can ordinarily be completed within the period between the payment at the time of substantial completion and final payment.

G. 1. This project is to be physically completed in accordance with the time limits set forth in the agreement between the Owner and Contractor and as further set forth in the project manual and/or bidding documents. Liquidated damages will be assessed in the amount of \$1,000.00 for each and every calendar day after such time allowed for completion.



2. Contractor realizes that time is of the essence on this Contract and the completion date and milestone date for each work item in its agreement, a Milestone Date reflected on the project schedule, or the date of substantial completion of the Contractor's work shall be no later than the date indicated therein. In the event the Contractor fails to complete any work or substantially complete the work under this contract by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of time in accordance with the provisions of this Article 13.

3. The said sum per calendar day shall constitute the Liquidated Damages incurred by the Owner for each day of delay beyond the agreed upon dates of Substantial Completion. Such Liquidated Damages shall be in addition to any other damages (other than by reason of delay) Owner may incur as a result of Contractor's breach of Contract. In the event that substantial completion of its work is not achieved in accordance with the project schedule, inspections will be performed once each week unless the Owner or the Architect determines, at their sole discretion, that additional inspections are not needed. All costs incurred by the Owner, Owner's Representative and the cost of additional inspections, at the rate of One Thousand Dollars (\$1,000) per inspection, will be subtracted from payment due the Contractor. If the amount due the Contractor for payment is insufficient, any deficiency shall be paid by the Contractor to the Owner.

H. 1. Within five (5) calendar days from the occurrence of same, the Contractor must apply in writing to the Owner, its Architect or Construction Manager for an extension of time to complete its work where it has been delayed as a result of: unforeseeable causes beyond the control and without the fault or negligence of the contractor, including acts of God, acts of the public enemy, acts of the federal or state government in either their sovereign or contractual capacities, fires, floods, epidemics, quarantine restrictions, priority or allocation orders duly issued by the federal government; freight embargoes; changes in the work to be performed by the Contractor. The Contractor may not apply for an extension of time for delays in acquisitions of materials other than by reason of freight embargoes. All other delays of the project, including but not limited to, Architect review and/or approval of shop drawings and/or submittals, requests for information, clarifications, samples, and change orders; Owner schedule; Architect certification of payment; payment by Owner of Contractor's Application for Payment; coordination amongst Contractors; unavailability of materials and/or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and, therefore shall not form the basis for a claim for an extension of time by the Contractor.

2. All claims for additional time shall be supported by documentation which demonstrates to the Architect and Construction Manager's satisfaction that the Critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the project at no cost. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's work when in its judgment such an extension is justified. The Owner's



determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its work shall be memorialized by written change order, signed by the Owner, Contractor, Architect and Construction Manager. Where the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following:

For each day of delay in the completion of its work, the Contractor shall be allowed one day of additional time to complete its contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently; only the actual period of delay as determined by the Owner or its Architect may be allowed.

3. Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under subparagraph H of this Article 13, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; or (4) other similar claims (collective referred to herein as "delay(s)"), unless a delay is caused by the Owner's active interference with the Contractor's performance of the Work, and only to the extent such acts continue after the Contractor furnishes the Owner with three (3) days' written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delay, including, but not limited to, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference with the Contractor's performance of the Work.

#### **ARTICLE 14 DEFICIENT AND INCOMPLETE WORK**

A. The Owner, through its Architect or Construction Manager, will have the authority to reject work performed by the Contractor which does not conform to the requirements of the drawings and/or specifications.

B. The Owner, through its Architect or Construction Manager, shall have the authority to require additional inspection or testing of the Contractor's work whether or not such work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the work to have performed additional inspection or testing of the work.



C. 1. If a portion of the Contractor's work is covered contrary to the Architect's request or to requirements specifically expressed in the drawings and/or specifications, upon request by the Architect or the Construction Manager, the Contractor shall uncover such work for the Architect's or any governmental authority's observation and be replaced at the Contractor's sole expense without change in the Contract Time or Contract Sum.

2. If a portion of the Contractor's work has been covered which the Architect or any governmental authority has not specifically requested to observe prior to its being covered, the Architect or any governmental authority may request to see such work and it shall be uncovered by the Contractor. If such work is in accordance with the drawings and/or specifications, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor, at its sole cost and expense, shall uncover and replace such work.

D. The Contractor shall promptly correct work rejected by the Owner, through its Architect or Construction Manager, or failing to conform to the requirements of its contract with the Owner, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the all costs of correcting such rejected work, including but not limited to the cost of said additional testing and/or inspection, the cost of the Architect's services incurred in conjunction with such additional testing, and any cost, loss or damages to the Owner resulting from such actions. If prior to the date of Substantial Completion, the Contractor, a Sub-contractor or anyone for whom either is responsible uses or damages any portion of the Work or premises, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

E. If the Contractor (1) fails to correct work which is not in accordance with the requirements of its agreement with the Owner, or (2) fails to carry out its work in accordance with the requirements of its agreement with the Owner, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the work within the contract time, or (4) fails to remove and discharge (within ten (10) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) disregards the instructions of the Architect, Owner or Construction Manager, the Construction Manager, on behalf of the Owner may order the Contractor to stop its work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to, and not in restriction of, other rights the Owner may have pursuant to these General Conditions or at law.

F. 1. If the Contractor defaults or neglects to carry out its work in accordance with its agreement with the Owner and fails within a three (3) day period after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued



deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect, the Construction Manager and the Owner and such other consultants whose participation is deemed necessary by the Architect, for additional services and expenses made necessary by such default, neglect or failure. Such action by the Construction Manager, including the amounts to be charged to the Contractor as a result of such action are subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2. Where the Contractor's default and/or neglect to carry out its work in accordance with its agreement with the Owner threatens the health, safety and/or welfare of the occupants of the school district's facilities and/or threatens the structural integrity and/or preservation of the school district's facilities, the Owner may proceed to carry out the Contractor's work upon twenty-four (24) hours notice of its intention to do so to the Contractor.

G. If the Owner prefers to accept work which is not in accordance with the terms and conditions of the agreement between the Owner and the Contractor, the Owner may, in its discretion, accept such work and reduce the Contractor's contract sum accordingly.

#### **ARTICLE 15 FINAL COMPLETION AND CLOSEOUT OF THE PROJECT**

A. 1. When advised by the Construction Manager that the Contractor's work is near substantial completion, the Architect shall visit the site to determine whether the Contractor's work is substantially complete. If the Architect's observations of the Contractor's work discloses any item which has not been performed in accordance with the requirements of the drawings and/or specifications and/or which has not been completed to the point indicated in Article 13 paragraph F of these General Conditions, the Contractor shall complete or correct such items upon receipt of notification from the Architect that a deficiency exists. The Architect shall not issue a certificate of substantial completion for the work of the Contractor until the work has been completed in accordance with Article 13(F). Upon completion of the work outlined by the Architect to it in accordance with this paragraph A, the Contractor shall advise the Architect of the need for an inspection of the work. If the Architect is required to inspect the Contractor's work more than twice, the Contractor shall be liable to the Owner for the services performed by the Architect as a result of additional inspections.

2. Upon determining that the Contractor's work has progressed to the point of Substantial Completion, the Architect shall prepare a punch list of the Contractor's work which shall include only minor items of work remaining to be performed by the Contractor to bring its work into compliance with the requirements of the drawings and/or specifications. The Contractor shall proceed promptly to complete and correct items on the punch list issued by the Architect and shall complete said items within thirty (30) days of its receipt of the punch list from the Architect. At the time of substantial completion, the Owner shall retain 200 percent of the value of the punch list items from the Contractor's remaining contract sum. The value of said remaining work shall be determined by the Architect. Upon completion of the work reflected in



the final punch list, the Owner shall release the monies withheld pursuant to this paragraph to the Contractor.

3. The Architect's failure to include an item of deficiency on the punch list issued to the Contractor shall not relieve the contractor of its responsibility to perform its work in accordance with the drawings and/or specifications.

B. 1. If within three (3) years after the date of Substantial Completion of the Contractor's work or designated portion thereof, or after the date for commencement of warranties established pursuant to these General Conditions, or by terms of in applicable special warranty required by the agreement between the Owner and the Contractor, any of the Work is found to be not in accordance with the requirements of said agreement, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of three (3) years shall be extended with respect to portions of the Contractor's work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of such work. The obligation set forth hereunder shall survive acceptance by the Owner of the Contractor's and/or termination of the Contractor's agreement with the Owner. The Owner shall give such notice within a reasonable period of time after discovery of the condition.

2. The Contractor shall, within a reasonable time after receipt of written notice thereof, but in no event no later than seventy-two (72) hours after receipt of such notice, commence to correct, repair, and make good any defects in its work.

3. The obligations of the Contractor pursuant to this paragraph shall cover any repairs to or replacement of work affected by the defective work.

4. In the case of any work performed in correcting defects pursuant to this paragraph, the guarantee periods specified herein shall begin anew from the date of acceptance by the Owner of such work.

C. Upon receipt of written notice from the Construction Manager that the Contractor's work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Contractor's work acceptable pursuant to the terms and conditions of its agreement with the Owner and the Contract fully performed and upon receipt of the closeout documentation required by the Contract Documents and elsewhere in the agreement between the Owner and the Contractor, the Architect will certify to the Owner that the Contractor is entitled to final payment on the project.

D. 1. Prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.

2. The Contractor shall schedule a close out meeting with the Architect and the Construction Manager for the purpose of delivering the close out documents required pursuant



to the Contract Documents and elsewhere in the agreement between the Owner and the Contractor.

E. If the Contractor's work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the warranty periods described in the Contract Documents shall be set by the Architect at his discretion.

F. If the Architect is required to perform more than one final inspection because the Contractor's work fails to comply with the requirements of the contract, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

G. Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those claims previously made in writing in accordance with the terms of Article 18 hereof and identified by that payee as unsettled at the time of final Application for Payment.

H. Contractor shall submit all documentation identified in this section within ninety (90) days from the date of Substantial Completion. If the documentation has not been submitted, the Owner will obtain same through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner in securing such documentation.

## **ARTICLE 16**

### **RELEVANT STATUTORY PROVISIONS**

A. The Contractor shall at all times observe and comply with all Federal and State Laws and all Laws, Ordinances and Regulations of the Owner, in any manner affecting the work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the work, and the Contractor shall indemnify and save harmless the Owner and all his officers, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by himself or by his employee or agents.

B. The Contractor and each of its subcontractors shall comply with Prevailing Wage Rates as issued by the State of New York Department of Labor for the location and duration of this Project and shall comply with all requirements governing its payments to its employees as set forth in Labor Law, section 220 et seq of the New York State Labor Law, as amended.

C. The Contractor and each of its subcontractors shall post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone number and addresses for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her particular job classification.



D. The Contractor specifically agrees, as required by Labor Law, Sections 220 and 220-d, as amended, that:

1. No laborer, workman or mechanic in the employ of the Contractor, subcontractor or other person doing or contracting to do the whole or any part of the work contemplated by the Contract, shall be permitted or required to work more than eight hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law.

2. The wages paid for a legal day's work shall not be less than the prevailing rate of wages as defined by law.

3. The minimum hourly rate of wages to be paid shall not be less than that stated in the Project Manual, and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of re-determination and shall form a part of this Contract. The Labor Law provides that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

a. The stipulated wage scale as provided in Labor Law, Section 220, Sub division 3, as amended; or

b. The stipulated minimum hourly wage scale as provided in Labor Law, Section 220-d, as amended.

E. The Contractor acknowledges that its work is governed by the provisions of Section 101 of the General Municipal Law of the State of New York.

F. The Contractor specifically agrees, as required by the provisions of the Labor Law of New York, Section 220-E, as amended that:

1. In the hiring of employees for the performance of this contract or any sub-contractor hereunder, no contractor, sub-contractor, nor any person acting on behalf of such contractor or sub-contractor shall by reason of race, creed, color or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates.

2. No contractor, sub-contractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, color, creed, sex or national origin.

3. There may be deducted from the amount payable to the Contractor a penalty of fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract.



4. This Contract may be canceled or terminated by the Owner and all monies due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

The aforesaid provisions of this section covering every Contract for or on behalf of the Owner, the State or a municipality for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial limits of the State of New York.

G. The successful Contractor shall conform to the guidelines spelled out in the County's Affirmative Action Program, if any.

H. The Contractor shall comply with all of the provisions of the Immigration Reform and Control Act of 1986 and regulations promulgated pursuant thereto and shall require its subcontractors to comply with same. The Contractor shall and does hereby agree to fully indemnify, protect, defend, and hold harmless the Owner, Owner's agents and employees from and against any penalties, fees, costs, liabilities, suits, claims, or expenses of any kind or nature, including reasonable attorney's fees, arising out of or resulting from any violation or alleged violation of the provisions of said laws in connection with the work performed hereunder.

I. This Contract shall be void if the Contractor fails to install, maintain, and effectively operate appliances and methods for the elimination of harmful dust when a harmful dust shall have been identified in accordance with Section 222-a of the Labor Law of the State of New York.

J. The Contractor shall insure that absolutely no asbestos containing material is used in conjunction with the performance of its work. The Contractor bears the sole responsibility to provide assurances that no asbestos containing material is built into the construction, or that any equipment used in the construction contains any asbestos containing material. If asbestos containing material is found, at any time during or after the construction is completed, it shall be the responsibility of the Contractor who installed said material to remove it and replace it with new non-asbestos containing material, as per federal, state and local mandates.

K. Large and small asbestos abatement projects as defined by 12 N.Y.C.R.R. 56 shall not be performed while the building is occupied. As referenced in this section, the term "Abuilding" shall mean a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier. Exterior work such as roofing, flashing, siding or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and windows is provided. Work must be scheduled so that classes are not disrupted by noise or visual distraction.

L. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the



specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

M. No smoking is allowed anywhere on school property per New York State and County law. Violators are subject to a \$1,000 fine and/or banishment from the property.

N. Applicable codes and standards for material furnished and work installed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and applicable requirements of following codes and standards, including but not limited to:

1. New York State Uniform Fire Prevention and Building Code, and amendments thereto.
2. New York State Energy Conservation Construction Code.
3. State Education Department Manual of Planning Standards.
4. New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition.
5. Life Safety Code - NFPA.

O. Wherever in the specifications reference is made to ANSI or ASTM Standards, Federal Specifications, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency in effect at the date of "Bid Issuance" shall be accepted as establishing the technical requirements for which compliance is required.

P. The Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of its agreement in the event (1) an order for relief is entered on behalf of the Contractor pursuant to Title 11 of the United States Code, (2) any other similar order is entered under any other debtor relief laws, (3) the Contractor makes a general assignment for the benefit of its creditors, (4) a receiver is appointed for the benefit of its creditors, or (5) a receiver is appointed on account of its insolvency. Failure to comply with such request within ten (10) days of delivery of the request shall entitle the Owner to terminate the Contract in accordance with Article 17 hereof. In all events, pending receipt of adequate assurance of performance and actual performance in accordance therewith, the Owner shall be entitled to proceed with the Contractor's work with its own forces or with other contractors on a time and material or other appropriate basis, the cost of which will be back charged against the Contractor.

Q. The Contractor shall maintain policies of employment as follows:

1. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer;

recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

2. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

#### ARTICLE 17 TERMINATION OR SUSPENSION

- A. 1. The Owner may terminate the Contractor's agreement in the event the Contractor:
- a. refuses or fails to supply sufficient skilled workers or suitable materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;
  - b. refuses or fails to correct deficient work performed by it;
  - c. fails to make prompt payments to subcontractors for labor, materials, and/or equipment in accordance with the respective agreements between the Contractor and the Subcontractors;
  - d. disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;
  - e. disregards the instructions of the Architect, Construction Manager or the Owner (when such instructions are based on the requirements of the Contract Documents);
  - f. is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act or to reorganize under bankruptcy or similar laws; or
  - g. breaches any warranty made by the Contractor under or pursuant to the Contract Documents.
  - h. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents; or



i. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents.

j. fails to keep the Project free from strikes, work stoppages, slowdowns, lockouts or other disruptive activity;

k. or otherwise does not fully comply with the Contract Documents.

2. When any of the above reasons exists, may without prejudice to any other rights or remedies of the Owner, terminate employment of the Contractor upon three (3) days written notice and may, subject to any prior rights of the surety:

a. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

b. take possession of materials stored off site by the Contractor;

c. take assignments of the Contractor's subcontractors in accordance with these General Conditions;

d. finish the Work by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 1 hereof, the Contractor shall not be entitled to receive further payment until the completion of the Contractor's work. If the Owner's costs to complete the Contractor's work, including the expenses incurred by the Owner in connection with the services of the Architect, the Construction Manager and/or other consultants, exceed the contract balance remaining on the Contractor's contract, the Contractor shall be liable to the Owner for such excess costs. This provision shall survive termination of the Contractor's agreement with the Owner.

B. 1. In addition to the Owner's right to carry out the work of the Contractor pursuant to its agreement with the Contractor, the Owner may at any time, at will and without cause, terminate any part of the Contractor's work or all of the Contractor's remaining work for any reason whatsoever by giving three (3) days' written notice to Contractor, specifying the portion of the Contractor's work to be terminated and the effective date of termination.

2. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- a. cease operation as specified in the notice;
- b. place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;
- c. terminate all subcontracts and orders to the extent they relate to the Work terminated;
- d. proceed to complete the performance of the remaining work on its contract which has not been so terminated; and
- e. take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

3. The Contractor shall continue to prosecute that portion of its work which has not been terminated by the Owner pursuant to this paragraph. If the Contractor's work is so terminated, the Owner shall not be liable to the Contractor by reason of such termination except that the Contractor shall be entitled to payment for the work it has properly executed in accordance with its agreement and prior to the effective date of termination (the basis for such payment shall be as provided in the Contract) and for costs directly related to work thereafter performed by Contractor in terminating such Work, provided such work is authorized in advance by the Architect and the Owner. No payment shall be made by Owner, however, to the extent that such work is, was, or could have been terminated under the Contractor's agreement with the Owner.

4. In case of a termination pursuant to this paragraph B, the Owner will issue a Construction Change Directive or authorize a Change Order, making any required adjustment to the Date of Substantial Completion and/or the sum of contract monies remaining to be paid to the Contractor. The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work, (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum; multiplied by 15% representing the Contractor's overhead and profit.

5. For the remaining portions of the Contractor's work which have not been terminated pursuant to this paragraph B, the terms and conditions of the Contractor's agreement with the Owner shall remain in full force and effect.

6. Upon termination of the Contractor's work or a portion of the Contractor's work pursuant to this paragraph B, the Contractor shall recover as its sole remedy, payment for work which it has properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives



and forfeits all other claims for payment and damages, including, without limitation, overhead and profit related to work terminated by the Owner pursuant to this paragraph B.

C. 1. In addition to Owner's right to suspend, delay, or interrupt Contractor from proceeding with any portion of its work pursuant to the terms and conditions of its agreement with the Owner, the Owner may at any time, at will and without cause suspend, delay, or interrupt any part of the Contractor's work or all work for any reason whatsoever for such period of time as the Owner may determine by giving three (3) days' prior written notice to Contractor, specifying that portion of the Contractor's work which is to be suspended, delayed, or interrupted, and the effective date of such suspension, delay, or interruption, as the case may be.

2. The Contractor shall continue to prosecute that portion of its work which has not been suspended, delayed, or interrupted, and shall properly protect and secure the portion of its work so suspended, delayed or interrupted.

3. The Owner shall incur no liability to Contractor by reason of such suspension, delay, or interruption except that Contractor may request an extension of its time to complete its work in accordance with Article 13 hereof.

D. The Contractor agrees and acknowledges that payments for the work have been obtained through obligations or bonds which have been sold after public referendum. In the event the work is suspended or canceled as a result of the order of any court, agency, department entity or individual having jurisdiction, or in the event the work is suspended or canceled due to the fact that a court, agency, department, entity or individual having jurisdiction has issued an order, the result of which is that the aforesaid obligations or bonds are no longer available for payment for the work, the Contractor expressly agrees that it shall be solely entitled to payment for work accomplished until a notice of suspension or cancellation is served upon it. The Contractor expressly waives any and all rights to institute an action, claim, cause of action or similar for any damages it may suffer as a result of the suspension or cancellation of the Work and/or its contract pursuant to this section.

## ARTICLE 18 CLAIMS AND DISPUTES

A. Definition. A "Claim" is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract.

B. Time Limits on Claims. Claims by the Contractor must be made within thirty (30) days after occurrence of the event giving rise to such Claim, or within thirty (30) days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. Claims must be made by written notice. An additional Claim made after the initial Claim has been decided by the Owner will not be considered unless submitted in a timely manner. Failure of the Contractor to



give timely notice of claim shall constitute waiver of the claim. Claims must be made by written notice to the Construction Manager, Architect and Owner. The responsibility to substantiate Claims shall rest with the Contractor.

C. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

D. Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Owner and Architect promptly before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; and, (3) in the case of a condition at the site which involves a hazardous or toxic substance, as those terms are defined by OSHA or AHERA, notice to the Owner, the Construction Manager and the Architect shall be given immediately upon discovery of such hazardous or toxic substance. The Architect, and/or Construction Manager will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Contractor in writing, stating the reasons.

E. Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum as a result of a Change in the Work pursuant to Article 8 of these General Conditions, written notice as provided in this Article 18 shall be given before proceeding to execute the Work.

F. Claims for Additional Time. If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall comply with the requirements set forth in Article 13.

G. Nothing contained in the Contract Documents shall relieve a Contractor from compliance with any statutory requirement, including, but not limited to those contained in Education Law Section 3813.

## ARTICLE 19 MISCELLANEOUS PROVISIONS

A. The agreement between the Owner and the Contractor shall be governed by the law of the place where the project is located; venue to be in the County in which the project is located.

B. Historical lack of enforcement of any law, local or otherwise, shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with its



agreement with the Owner unless and until the Contractor has received written consent for the waiver of such compliance from the Owner and the Agency responsible for the enforcement of such law.

C. All notices to be given hereunder shall be in writing and may be given, served, or made (1) by depositing the same for first class mail delivery in the United States mail addressed to the authorized representative of the party to be notified; (2) by depositing the same in the United States mail addressed to the authorized representative of the party to be notified, postpaid and registered or certified with return receipt requested; (3) by depositing the same for overnight delivery (prepaid by or billed to the party giving notice) with the United States Postal Service or other nationally recognized overnight delivery service addressed to the authorized representative of the party to be notified; or (4) by delivering the same in person to the said authorized representative of such party. Notice deposited in the mail by certified mail or overnight delivery in accordance with the provisions hereof shall be effective from and after the fourth (4th) day next following the date postmarked on the envelope containing such notice, or when actually received, whichever is earlier. All notices to be given to the parties hereto shall be sent to or made at the addresses set forth hereinbelow. By giving the other parties at least seven (7) days' written notice thereof, the parties hereto shall have the right to change their respective addresses and specify as their respective addresses for the purposes hereof any other address in the United States of America.

D. Except as expressly provided in the agreement between the Owner and the Contractor, duties and obligations imposed by such agreement and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law, or in equity or by other agreement, and such rights and remedies shall survive acceptance of the Contractor's work and/or any other termination of the Contractor's agreement with the Owner.

E. No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

F. The headings denoting the separately numbered Articles of these General Conditions are specifically set forth for reference purposes only and are not in any way to be deemed explanatory of or limiting of the contents of any paragraph or subparagraph. Furthermore, said headings are not to be deemed part of this Agreement for purposes of interpretation, litigation or as defining or limiting the rights or obligations of the parties.

G. In case any provision of this Agreement should be held to be contrary to, or invalid, under the law of any country, state or other jurisdiction, such illegality or invalidity, shall not affect in any way, any other provisions hereof, all of which shall continue, nevertheless, in full force and effect in any country, state or jurisdiction in which such provision is legal and valid.



H. The rights stated in these General Conditions and the documents which form the agreement between the Owner and the Contractor are cumulative and not in limitation of any rights of the Owner at law or in equity.

I. The Owner shall not be responsible for damages or for loss of anticipated profits on work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's work pursuant to its agreement with the Contractor.

J. The Owner shall not be liable to the Contractor for punitive damages on account of any its termination of the Contractor or any other alleged breach of the agreement between it and the Contractor and the Contractor hereby expressly waives its right to claim such damages against the Owner.

K. The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect or the Construction Manager taken in connection with the Contractor's work on the Project.

L. Upon determination by legal means (e.g. court action, etc.) that termination of Contractor pursuant to Article 17.A.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Article 17.B.1 and Contractor's remedy for such termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Article 17.B.1.

M. As between the Owner and Contractor:

1. Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
2. Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
3. After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to warranties provided in accordance with its agreement with the Owner, the date of any correction of work performed by the Contractor or failure to correct its work, or the date of actual commission of



any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

N. 1. The Owner may occupy or use any completed or partially completed portion of the Contractor's work at any stage when such occupancy is authorized by public authorities having jurisdiction over the project.

2. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Contractor's work, nor does it waive the Owner's right to liquidated damages. Further such occupancy alone shall not determine when substantial completion and performance has been reached.

3. Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Contractor's work, and in order to prepare a complete punchlist of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

O. The Contractor agrees not to assign, transfer, convey or sublet or otherwise dispose of this Contract or his right, title and interest therein or his power to execute such Contract, to any other person, firm or corporation without the previous consent in writing of the Owner.

P. The Owner is a tax exempt organization and will take title to materials used in the Project in order to permit tax exemption.

Q. The Owner will furnish a certificate with the Owner's Tax Exemption Number to the Contractor for use in purchasing tangible personal property required for the Project.

R. This exemption shall not apply to machinery, equipment, tools, and other items purchased, leased, rented, or otherwise acquired for the Contractor's use even though the machinery, equipment, tools or other items are used either in part or entirely on the Work. This exemption shall apply only to materials fully incorporated into the Work of the Contract as accepted and approved by the Architect.

S. The Contractor shall, upon request by the Owner, furnish a bill of sale or other instrument indicating the quantities and types of materials purchased directly by the Contractor or subcontractor for incorporation into the Work. Upon delivery of the materials to the site, the Contractor shall mark or otherwise identify the materials to be incorporated into the Work. This exemption shall apply only to materials so identified and accepted.

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***END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION***

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SECTION 007001 – REQUISITION FOR PARTIAL PAYMENT – WAIVER OF LIENS

<b>PROJECT</b>	<b>OWNER</b>
<b>GENERAL CONTRACTOR</b>	<b>SUB-CONTRACTOR/VENDOR</b>
<b>CONTRACT</b>	<b>WORK COMPLETE</b>
PROJECT:	CONTRACT - \$
TRADE:	CHANGE ORDERS - \$
CONTRACT - \$	TOTAL COMPLETE - \$
TOTAL CONTRACT - \$	RETAINAGE (        %) - \$
	LESS PRE. REQ. - \$
	THIS REQUISITION - \$

Waiver of Lien

The undersigned, upon receipt of the above requisition payment hereby releases and discharges the Owner of and from any liability or obligation in any way related to or arising out of this project up to and including the date of this document.

The undersigned further covenants and agrees that it shall not in any way claim or file a mechanic's or other lien against the premises of the above designated project, or any part thereof, or against any fund applicable thereto for any of the work, labor, or materials heretofore furnished by it in connection with the improvement of said premises.

The undersigned further warrants that, in order to induce the Owner to release this partial payment, they have paid all claims for labor, material, insurance, taxes, equipment, etc., employed in the prosecution of the work above, to date of this requisition.

The undersigned hereby releases and agrees to hold the Owner harmless from any and all claims in connection with the furnishing of such labor and materials, etc., for the construction of the aforementioned project.

The undersigned further guarantees that all portions of the work furnished and/or provided by them are in accordance with the Contract and that the terms of the Contract with respect to these guarantees will hold for the period specified in said Contract.

IN WITNESS WHEREOF, we have executed under seal this release on the above date and to be legally bound hereby:

WITNESS: \_\_\_\_\_ FIRM: \_\_\_\_\_

BY: \_\_\_\_\_



**CORPORATE ACKNOWLEDGEMENT**

State of

)SS.  
)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that s/he resides at

\_\_\_\_\_, \_\_\_\_\_;  
that s/he is the officer of the said corporation executing the foregoing instrument, that s/he knows the seal  
of said corporation, that the seal affixed to said instrument is such corporate seal, that it was so affixed by  
order of the Board of Directors of said corporation and that s/he signed her/his name thereto by like order.

\_\_\_\_\_  
Notary Public

**INDIVIDUAL ACKNOWLEDGEMENT**

State of

)SS.  
)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that s/he resides at

\_\_\_\_\_, \_\_\_\_\_;  
that s/he is the individual who executed the foregoing instrument.

\_\_\_\_\_  
Notary Public

**PARTNERSHIP ACKNOWLEDGEMENT**

State of

)SS.  
)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that s/he resides at

\_\_\_\_\_, \_\_\_\_\_;  
that s/he is the partner in the firm of \_\_\_\_\_  
doing business under the name of \_\_\_\_\_  
and that s/he executed the foregoing instrument of behalf of said partnership.

\_\_\_\_\_  
Notary Public

U.S. Wage and Hour Division  
Rev. Dec. 2008

OMB No.: 1235-0008  
Expires: 01/31/2015

**Expires: 01/31/2015**

PROJECT OR CONTRACT NO.

While completion of Form WH-347 is optional, (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(e), The Copeland Act (29 C.F.R. § 5.5(a)(3)(i)) requires contractors to submit weekly a copy of all payrolls to the Federal agency conducting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3302, 200 Constitution Avenue, N.W., Washington, D.C. 20210

(over)

Date \_\_\_\_\_

I, \_\_\_\_\_ (Name of Signatory Party) \_\_\_\_\_ (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

\_\_\_\_\_ (Contractor or Subcontractor) \_\_\_\_\_ on the \_\_\_\_\_ day of \_\_\_\_\_, and ending the \_\_\_\_\_ day of \_\_\_\_\_, that during the payroll period commencing on the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_ (Building or Work) \_\_\_\_\_, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said \_\_\_\_\_ from the full \_\_\_\_\_ (Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967, 76 Stat. 357, 40 U.S.C. § 3145), and described below:

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ -- in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ -- Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

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NAME AND TITLE	SIGNATURE
THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.	

## INSURANCE REQUIREMENTS

Please refer to Article 11 of the General Conditions concerning the insurance requirements.

1. Notwithstanding any terms, conditions or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the District/BOCES as an Additional Insured on the contractor's insurance policies, except for workers' compensation and N.Y. State Disability insurance.
2. The policy naming the District as an Additional Insured shall:
  - a. Be an insurance policy from an A.M. Best A- rated or better insurer, licensed to conduct business in New York State. A New York licensed and admitted insurer is strongly preferred. The decision to accept non-licensed and non-admitted carriers lies exclusively with the District/BOCES and may create significant vulnerability and costs for the District/BOCES.
  - b. State that the organization's coverage shall be primary and non-contributory coverage for the District/BOCES, its Board, employees and volunteers.
  - c. Additional insured status shall be provided by standard or other endorsements that extend coverage to the District/BOCES for on-going operations (CG 20 38) and products and completed operations (CG 20 37). The decision to accept an endorsement rest solely with the District/BOCES. A completed copy of the endorsements must be attached to the Certificate of Insurance.
3.
  - a. The certificate of insurance must describe the services provided by the contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.
  - b. At the District's/BOCES' request, the contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor will provide a copy of the policy endorsements and forms.
  - c. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Form– additional details must be provided in writing.
4. The contractor agrees to indemnify the District/BOCES for applicable deductibles and self-insured retentions.
5. Minimum Required Insurance:
  - a. **Commercial General Liability Insurance**
    - \$1,000,000 per Occurrence/ \$2,000,000 Aggregate
    - \$2,000,000 Products and Completed Operations
    - \$1,000,000 Personal and Advertising Injury
    - \$100,000 Fire Damage
    - \$10,000 Medical Expense
    - The general aggregate shall apply on a per-project basis.
  - b. **Owners Contractors Protective (OCP) Insurance**

For projects less than or equal to \$1,000,000 and work on 1 story (10 feet) only; \$1 million per occurrence, \$2 million aggregate with the District/BOCES as the Named Insured. For projects greater than \$1,000,000 and/or work over 1 story (10 feet); \$2 million per occurrence, \$4 million aggregate with the District/BOCES as the Named Insured.

For all projects where General Liability, Auto and Umbrella/Excess Coverage is with non-licensed and non-admitted carriers in New York State; \$2 million per occurrence, \$4 million aggregate with the District/BOCES as the named Insured.

The District/BOCES will be the Named Insured on OCP Policies. There will be no Additional Insureds on any OCP Policies. The OCP Policies will be written by NYS Licensed and Admitted Carriers.

**c. Automobile Liability**

\$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

**d. Workers' Compensation and NYS Disability Insurance**

Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

**e. Builder's Risk**

Must be purchased by the contractor to include interest of the Owner and Contractor jointly in a form satisfactory to the owner. The limit must reflect the total completed value – all material and labor costs and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood.

**f. Umbrella/Excess Insurance**

\$5 million each Occurrence and Aggregate for general construction and no work at elevation (1 story – 10 feet) or project values less than or equal to \$1,000,000. \$10 million each Occurrence and Aggregate for high risk construction, work at elevation (>1 story or 10 feet) or project values greater than \$1,000,000. Umbrella/Excess coverage shall be on a follow-form basis.

6. Contractor acknowledges that failure to obtain such insurance on behalf of the District/BOCES constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the District/BOCES. The contractor is to provide the District/BOCES with a certificate of insurance, evidencing the above requirements have been met, prior to the commencement of work.
7. Sub-contractors are subject to the same terms and conditions as stated above and must submit same to the District/BOCES for approval prior to the start of any work.
8. In the event the Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the District/BOCES, its Board, employees and volunteers from any and all claims for which the required insurance would have provided coverage. **This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**



**All limits carried in excess of the above amounts must be shown on the Certificate of Insurance, and all parties listed above must be added as additional insured for all limits so carried.**

Coverages regardless of policy form, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment.

HOLD HARMLESS: The awarded contractor will be required to sign a "Hold Harmless" Agreement with the School District as included with this document. Compliance with the foregoing requirement for insurance shall not relieve the Contractor from liability set forth under the Indemnity Agreement.

LAWS, ORDINANCES, CODES, ETC: The contractor shall comply with all laws, codes, rules and regulations of the State, County and City applicable to the work to be performed at the site.

PERMITS: Any and all permits lawfully required to prosecute the work and all approvals of work performed, required by authorities having jurisdiction, shall be obtained by the contractor who shall pay all lawful charges for same.

Workers shall be skilled in the trade in which employed and, where required, shall be licensed to perform the work by the authority having jurisdiction.

All work shall comply with codes, Local, State and National of all authorities having jurisdiction, including but not limited to National Electric Code, Plumbing Codes and OSHA regulations.

LABOR LAWS: Particular attention is directed to the Labor Laws of the State of New York applicable to the employment of labor at the site, which laws form part of this contract. The minimum hourly rate of wages to be paid for labor employed at the site is as determined by the Industrial Commissioner of the State of New York.



STATE OF NEW YORK            )  
  s.s.:  
COUNTY OF \_\_\_\_\_ )

\_\_\_\_\_ (name), President/CEO/Owner/Managing Member of  
\_\_\_\_\_ (bidder), hereby deposes and says that the bidder currently  
has, or immediately upon being awarded the contract, will obtain insurance coverage, from an insurer  
licensed and admitted to do business in New York, that meets the following requirements:

1. Workers' Compensation and Disability:

Coverage	Statutory
Extensions	Voluntary compensation
	All states coverage employers
	Employer's liability - unlimited

2. Commercial General and Umbrella Liability

Coverage	Occurrence using ISO occurrence Form CG 00 01 07 98 or later form
----------	--

Limits per project	General Aggregate - \$2,000,000.00 on a per project basis
	Products - Completed/Operations - \$2,000,000.00
	Personal & Advertising Injury - \$1,000,000.00
	Fire Damage (any one fire) - \$100,000.00
	Medical Expenses (any one person) - \$10,000.00

Owners and Contractors Protective Liability Insurance:

- a. \$2,000,000 per occurrence, \$4,000,000 general aggregate for contracts greater than \$1,000,000, or any contracts involving scaffolds or work above a height of one story.
- b. \$1,000,000 per occurrence, \$2,000,000 general aggregate for contracts less than or equal to \$1,000,000 that do not involve scaffolds or work above a height of one story.

Excess Liability (excess coverage shall be on a follow-form basis):

- a. \$10,000,000 for contracts greater than \$1,000,000, or any contracts involving scaffolds or work above a height of one story.
- b. \$5,000,000 for contracts less than or equal to \$1,000,000 that do not involve scaffolds or work above a height of one story.

3. Automobile Liability (all vehicles hired or non-hired): \$1,000,000.00 per accident

4. If this project requires the removal of asbestos and/or hazardous materials, Contractors shall provide hazardous material liability insurance as follows:

\$2,000,000 per occurrence/\$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract. If motor vehicles are used for transporting hazardous materials, the Contractor shall provide pollution liability broadened coverage (ISO endorsement CA 9948), as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years following acceptance by the District of the Certificate of Completion.

5. Testing Company Errors and Omission Insurance:

\$1,000,000 per occurrence/\$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.

If written on a "claims-made" basis, the retroactive date must pre-date the inception of the Contract or agreement. Coverage shall remain in effect for two years following the completion of work. The testing company shall also provide proof of Workers' Compensation and NY State Disability Benefits Insurance, Commercial General Liability and Excess Liability with limits of \$2,000,000 each occurrence and in the aggregate.

Print Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Sworn to before me this \_\_\_\_\_

day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
Notary Public

## SECTION 010000 - GENERAL REQUIREMENTS

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1.1 Summary of Work: Definitions: The word "provide" means furnish and install complete. The word "Contractor" means the proper trade referred by its reference.

The contractor is referred to the "Instructions to Bidders", "Bid Form", "Form of Bid Bond", "Form of Contract", "Performance and Payment of Bonds", "General Conditions", "Supplementary General Conditions", "Contract Drawings", and any "Amendments" to any foregoing, all of which are hereby made part of this contract.

1.2 Submittals: A progress schedule shall be submitted to the Construction Manager by the Contractor prior to initiation of work and shall be adhered to at all times. Any deviation from the schedule shall be brought to the immediate attention of the Construction Manager.

Before work is started, the Contractor shall submit to the Construction Manager for approval a list of materials, with trade names, proposed to be furnished (4 copies) and shop drawings as requested by the



Construction Manager. Submittals shall be representative of materials to be used by the Contractor in completing his work.

1.3 Progress Payments: Prior to the start of work, the Contractor shall submit a complete payment breakdown to the Construction Manager. Payments will be made by the Owner in accordance with Article 9 of the General Conditions. The Contractor shall submit applications for payment on the forms prescribed and approved by the Owner as set forth in these specifications.

1.4 Materials Handling:

1.4.1 Delivery: The Contractor shall be responsible for all materials being delivered in manufacturer's original unopened containers with manufacturer's labels intact and legible.

1.4.2 Storage: Storage space for materials and equipment is considered limited and the Contractor will schedule deliveries to minimize space required for storage.

The Contractor shall place and store materials and equipment in spaces agreed upon by the Owner, Construction Manager, and Contractor. The contractor shall provide continuous protection against damage or loss.

1.4.3 Waste Materials: All waste materials shall be stored and removed from the site in a manner agreed upon by the Contractor, the Owner, and the Construction Manager daily. In the event material and debris are left at the site and not removed in accordance with the specifications, the Owner may remove the offending materials at the Contractor's expense. Please refer to Article 4 of the General Conditions concerning the Contractor's disposal of waste material.

1.5 Special Conditions:

1.5.1 Visit to Site: The Contractor shall examine the drawings and specifications; must visit the site and note all field conditions which will influence the work required by his contract. The Contractor must verify the data noted in the drawings and specifications. He shall report any discrepancies between the bid documents and the field conditions to the Architect/Engineer/Construction Manager no later than five (5) days before the bids are due so that the Architect/Engineer/Construction Manager may issue clarification addenda if required. Failure to report any discrepancies within the time frame noted, will nullify any extra cost claim by the Contractor, if claim is based on discrepancies between specifications, drawings, and field conditions.

1.5.2 Protection: Contractor shall be responsible for the existing building, new work, new facilities, and improvements within the area where his work is being accomplished. Any damage to these resulting directly or indirectly from the Contractor's operations shall be promptly corrected at the Contractor's expense.

Provide all necessary temporary enclosures, covers, guardrails, barricades, safety devices, etc., to adequately protect all workmen and the public, especially children, from possible injury due to the various processes required to accomplish the work required. Provide all necessary temporary partitions, enclosures, and coverings for the confinement of dust, dirt, and debris.

Temporarily protect partially completed construction items such as structural steel, roof deck, roofing, insulation, exposed wall cavities, interior walls, etc., as needed to protect against weather damage.

1.5.2.1 The Contractor is responsible for maintaining all temporary emergency egress routes. The Contractor shall obtain approval from the Building and Fire Departments for all temporary emergency egress routes.

1.5.2.2 The Owner has the right to require disruptive work to be discontinued if affecting the students and staff. In such event, Contractor will perform the work during times and days when the Owner's operations will not be affected and at no additional cost to the Owner.

1.5.3 Security and Safety: The Contractor shall maintain adequate security at all times to protect the materials and work in place from damage, theft, malicious mischief and vandalism. The Contractor shall also observe and comply with all codes and regulations applicable to the safety of employees, tenants, and the general public. The Contractor, specifically, shall meet all requirements of OSHA as published in the Federal Register and procurable from the Government Printing Office, and the New York Department of Labor Safety Regulations as related to the construction work.

The Contractor shall meet all requirements of the Department of Health (DOH) and State and Federal guidelines preventing the spread of COVID-19 on the jobsite.

All work shall be performed with the safety of the building occupants, students, and staff taken into consideration.

1.5.4 Supervision: All work specified herein shall be carried out under the direction of the Construction Manager and with the approval of the coordinator of building services of the Owner with the least interference with the routine use of the building. All materials, equipment, etc., shall be stored where and as directed.

The coordinator of building services shall determine the compliance with the terms of this specification and any subsequent contract based upon same and his decision shall be final and conclusive as to the intent of the specifications and the sufficiency in quality and quantity of any work performed or material furnished in connection with the work covered by the specifications. The Construction Manager shall assist and advise the coordinator as necessary.

1.5.5 Installation: The complete installation shall be in accordance with the latest rules and regulations of the Boards and Departments having jurisdiction.

Any item or requirement necessary for a complete installation but not specifically described in this specification shall conform to the governing rules and regulations.

The Contractor shall procure all the necessary and usual certificates for all work installed by him and deliver same to the Architect and Construction Manager before final acceptance.

The Contractor is responsible for all rigging, scaffolding, and hoisting that is required in order to install the equipment as specified.

1.5.6 Existing Work: Existing work shall be cut, drilled, altered, removed or temporarily removed and replaced as necessary for the performance of the contract. However, unless otherwise provided by the specifications, no structural members shall be cut or altered without the authorization of the Engineer. Work remaining in place which is damaged or defaced by reason of work as done under this contract, shall be restored equal to its condition at the time of the award of this contract.

1.5.7 Existing Equipment: Equipment temporarily removed as a result of work under this contract shall be protected, cleaned, and replaced equal to its condition at the time of the award of this contract.

1.6 Coordination: All work shall be coordinated with the Owner, Architect, Engineer, and Construction Manager.

1.6.1 School Operations & Contractor Work Hours: During the Summer, work will be permitted between **7:00 a.m. and 4:00 p.m.** during the normal work days, Monday through Friday and Saturday as per local ordinances. However, when school is in session, work hours shall be from 3:00 p.m. to 11:00

p.m., Monday through Friday. All after hours work must comply with the allowable working hours and noise ordinance for the **Village of Larchmont**.

Each Prime Contractor may work Saturday & Sundays to make up for lost time (Saturday/Sunday work will be required if necessary to meet deadline) with prior approval from the Owner and after Contractor has verified allowable working hours by town ordinance. Contractors wishing to work on weekends or additional hours during the week shall pay for custodial hours related to same.

Consideration will be given to perform work DURING School Hours provided the area of work has a dedicated access route that does not interfere with the Students & Staff as well as NOT creating any noise in excess of 60dB as mandated by SED guidelines. After Hours work would also be required for any heavy construction work (i.e. piles, steel, etc.) that might pose a potential safety hazard to Students & Staff.

Due to extreme traffic congestion associated with student car and bus transportation, deliveries to any area of the project WILL NOT be allowed during school days from 8:00 a.m. to 9:00 a.m. and 2:00 p.m. to 3:30 p.m.

This Contractor will provide in their base bid five (5) "black out days", to the construction schedule where no work can take place. These dates will be determined by the District and have been incorporated into the milestone dates indicated in the attached bid schedule.

The Contractor shall not interfere with the operation of existing essential services during all normal operating hours and periods. All work requiring temporary interruption of essential services shall be done only with the specific approval of the Construction Manager and Owner. The Contractor shall set up a schedule of work affecting existing services for approval by the Owner and the Construction Manager.

Separate access to the construction activities will have to be provided by the General Contractor, since school will be in session while part of the construction is on-going. The General Contractor will provide temporary stairs, scaffolding, doors, etc. to provide separate access for all trades to the construction areas.

1.6.2 School District Holidays: Coordinate with the District for access to work during school holidays as listed below. Hours of work to be from 7:00 a.m. to 4:00 p.m.

Labor Day  
Rosh Hashanah  
Yom Kippur  
Columbus Day  
Veterans' Day  
Thanksgiving  
Winter Recess  
Martin Luther King  
Presidents' Recess  
Spring Recess  
Memorial Day

1.6.3 School District Events: Coordinate with the District for access to work during days where there are no students present (Superintendent Conference Days, etc.). Hours of work to be determined by the owner for each day.

1.6.4 Exam/Testing Schedule: Coordinate with the District for access to work during days when testing will take place at the schools. Hours of work to be from 3:00pm – to 11:00pm (After Hours)

1.7 As-Builts: The Contractor (each prime contractor), upon completion of installation of work, shall provide the Owner with as-built drawings (4 copies) to be approved by the Design Architect or Engineer.

These drawings shall show the exact location and invert of all items installed and/or altered by the Contractor.

1.8 Time of Completion: The Contractor, prior to being awarded the contract, shall prepare and submit for the Construction Manager's and Owner's approval, a progress schedule for the work. The progress schedule shall be related to the entire project to the extent required by the contract documents. This schedule shall indicate the dates from the start of work to completion and shall be revised as required by the conditions of the work subject to the Construction Manager's approval. Any departure from the schedule shall be brought to the attention of the Construction Manager.

The Contractor in preparing his schedule shall comply with the requirements on Table 1-1 which lists the completion date from the contract award date.

Any objections by a prospective bidder to this time schedule shall be submitted in writing to the Engineer at least ten (10) calendar days before the date of the bid opening.

1.9 Liquidated Damages: This project is to be physically completed in accordance with the time limits set forth in the agreement between the Owner and Contractor and as further set in the project manual and/or bidding documents. Liquidated damages will be assessed in the amount of \$1,000.00 for each and every calendar day after such time allowed for completion.

1.10 Insurance:

See Specification Section 007316 and General Conditions Article 10

1.11 Substitutes/Equivalents: Where two or more kinds, types, brands, manufacturers, or materials are named in these specifications, they are to be regarded as the required standard of quality and are presumed to be equal. The contractor may select one of these items or, if the contractor desires to use any kind, type, brand, manufacturer, or materials other than those named in the specifications, the contractor shall indicate in writing, when requested, and prior to the award of contract, what kind, type, brand, manufacturer or material is included in the base bid for the specified item.

1. Bidder must prove equivalence of substitution and furnish detailed specifications and catalog cuts or drawings. Failure to identify exceptions or deviations from equipment specified must be interpreted to indicate that the product offered complies with the specification in every respect.
2. Please refer to Article 6 of the General Conditions for additional information on equivalents and substitutions.

1.12 Guarantees:

1. Guarantees shall be furnished by all prime contractors for all labor and materials for a period of three (3) years as set forth in the General Conditions.
2. If guarantee/warranty periods are listed in individual technical sections, or any other Division 0 or 1 sections, the longer period shall be provided.

1.13 Communications: Should there be any problems with the contract in terms of working conditions, cooperation of the owner personnel, tenants, vandalism, job safety, stolen equipment and materials, unusual field conditions; the Contractor will immediately notify the Construction Manager and the owners representative in writing for resolution by the Owner.

1.14 Protection:

1. Provide all required protective measures for removal work. Give particular attention to the protection requirements so as to prevent any damage to existing construction or to adjoining public and private property, including thoroughfares. The Contractor will be held responsible and shall restore at his own expense any such damage to the complete satisfaction of the Construction Manager.
2. Protect adjoining public and private property, including thoroughfares, from damage due to disposal operations.
3. Protect from damage all heating, plumbing, and electrical lines to remain.
4. Take extreme care to protect the occupants of adjoining areas and prevent any harm to them through the required operations.

1.15 Indemnity:

1. Each prime contractor shall refer to Article 12 of the General Conditions.

1.16 Removal and Disposal of Debris:

1. Each prime contractor is responsible for removal from the building and off-site disposal of all rubble, trash, combustible materials and debris of all kinds created by and in the construction of this project. This includes all debris created by or connected with the operations of all contractors, sub-contractors and material suppliers engaged in the construction.
2. Each prime contractor shall pay all costs, fees, and permits attendant to the loading, unloading, cartage, dumping and disposal of all rubbish, and/or debris. No other contractor, sub-contractor, or material supply man shall be obliged to pay any costs attendant to this operation. The complete removal of all debris shall be performed with such frequency as to maintain the grounds around the building free from debris. Materials and debris removed will be loaded directly into waiting trucks or containerized vehicles so as not to litter the adjacent grounds.
3. In addition, the building and grounds will be maintained in a clean and orderly manner so as to conform with all local fire safety regulations and in accordance with the latest editions of the Safety Code of the National and State Board of Fire Underwriters.
4. Areas designated by Construction Manager will be the only place the contractor will be allowed to load and off load usable materials and/or debris. He shall at no time block the fire exists of the building. He will further repair any damage done to the sidewalks, pavements, and lawn areas upon completion of the project.

1.17 Ingress, Egress, and Circulation: Each prime contractor shall be responsible for performing his construction activities in such manner to maintain essential ingress and egress for visitors and occupants of Owner-occupied areas and to continuously maintain all required emergency exits from and circulation between existing facilities. Passageways for emergency exits shall be kept continuously free from debris, construction equipment, tools, stockpiles of materials, and other hazards to speedy evacuation. The contractor shall provide all necessary temporary work as prudence and good practice may dictate and in



accordance with Public Law, to obtain and maintain all such ingress, egress, and circulation requirements. All temporary work shall be removed when no longer required.

1.18 Non-Interference with Owner's Operations: Each prime contractor shall acquaint himself with the general character of the Owner's operations prior to commencing work and shall so schedule his work to avoid interference therewith. The sequence of demolition and removal operations shall be in accordance with a schedule of contract operations approved by the Owner and Construction Manager.

1.19 Sequence of Work:

1. An approved Sequence of Work will be established for the work of this project that will not interfere with the Owner's operations. The Sequence of Work may be modified from time to time by the Owner if changes in his schedule of activities require it.
2. The Owner will occupy the existing building and the outdoor facilities during normal business hours and also for after hours activities.
3. Emergency exit ways shall be kept clear at all times that people are in the building.

1.20 Final Cleaning Up:

1. Just prior to the Architect, Engineer and Construction Manager's inspection tour to establish the date of Substantial Completion, Contractor shall do final cleaning of materials and equipment installed under the contract.
2. The Contractor shall restore the areas of the building or the site, damaged by his work, to its original condition.
3. Contractor shall be responsible for the proper cleaning of all equipment furnished under this contract and for the removal of rubbish, packing cases and debris.

1.21 Storage: Storage space for materials and equipment is considered limited and the Contractor will schedule deliveries to minimize space required for storage.

The Contractor shall place and store materials and equipment in spaces agreed upon by the Owner, Construction Manager, and Contractor. The Contractor shall provide continuous protection against damage or loss.

1.22 Reserved

1.23 Engineer's Inspections: Accommodate Engineer's inspections by providing manpower, equipment, etc. as required by the inspector. Assist the inspector as requested.

1.24 Contract Location:

Chatsworth Avenue School  
34 Chatsworth Ave  
Larchmont, NY 10538

1.25 Installation: The complete installation shall be in accordance with the latest rules and regulations of the Boards and Departments having jurisdiction.

Any item or requirement necessary for a complete installation but not specifically described in this specification shall conform to the governing rules and regulations.

Each prime contractor shall procure all the necessary and usual certificates for all work installed by him and deliver same to the Construction Manager before final acceptance.

Each prime contractor is responsible for all rigging, scaffolding, and hoisting that is required in order to install the equipment as specified.

1.26 Code Requirements: All work performed, and materials furnished, shall be done in strict accordance with current requirements of the State and local codes as may apply including all revisions and authorized standards to date. The following is a partial list of applicable codes:

1. 2015 International Existing Building Code (as adopted by New York State)
2. 2015 International Building Code (as adopted by New York State)
3. 2015 International Mechanical Code (as adopted by New York State)
4. 2015 International Plumbing Code (as adopted by New York State)
5. 2015 Energy Conservation Code (as adopted by New York State)
6. 1998 NYSED Manual of Planning Standards
7. National Electric Code (NEC)
8. National Fire Protection Association (NFPA)
9. ICC/ANSI A117.1 - 2009 American National Standard

1.27 Permits and Inspections: Each prime contractor shall obtain and pay for any necessary Municipal or State inspection and permit as required by the inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representative.

1.28 Shop Drawings, Product Data, and Samples:

1. Work Included:
  - a. Submit to Construction Manager, all shop drawings, product data, and samples as required by these specification sections.
  - b. Designate construction schedule dates for submission, and dates shop drawings reviewed, product data and samples will be needed for each product.
  - c. Contractor must stamp all submittals with "approval stamp" before submitting to the Construction Manager/Architect.
2. All submissions shall be sent electronically in pdf format directly to the Architect/Engineer copying the Construction Manager. Submissions will be either via email or a data sharing website. The **Submittal Exchange** website service designed specifically for transmitting submittals between construction team members may also be used for this project ([www.submittalexchange.com](http://www.submittalexchange.com)). If so, the costs for this service will be paid for by the School District and log in credentials will be assigned to the Prime Contractors.
3. Shop Drawings:

- a. Original drawings prepared by Contractor, Sub-Contractor, supplier or distributor, which show some portion of the work, showing fabrication, layout, setting, or erection of details.
  - b. Prepared by qualified details.
  - c. Identify details by reference.
- 4. Product Data:
  - a. Manufacturer's Standard Schematic Drawings:
    - 1. Modify drawings to delete information which is not applicable to the project.
    - 2. Supplement standard information to provide additional information applicable to project.
  - b. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
    - 1. Clearly mark each copy to identify pertinent materials, products or models.
    - 2. Mark each item with the appropriate specification reference.
    - 3. Show dimensions and clearances required.
    - 4. Show performance characteristics and capacities.
    - 5. Show wiring diagrams and controls.
    - 6. Indicate any deviations for characteristics specified clearly.
- 5. Samples:
  - a. Where called for in specifications or required by Architect/Engineer, provide physical examples to illustrate materials, equipment or workmanship and to establish standards by which completed work is judged.
  - b. Provide office samples of sufficient size and quantity to clearly illustrate:
    - 1. Functional characteristics of products or material with integrally related parts and attachment devices.
    - 2. Full range of color samples.
    - 3. After review samples may be used in construction of the project.
  - c. Clearly identify each sample with appropriate specification reference and clearly indicate any deviation from specification.
- 6. Contractor's Responsibilities:
  - a. Review shop drawings, product data, and samples prior to submission, make certain that items conform to specifications and requirements of work, and so certify when submitting items for approval.
  - b. Verify:
    - 1. Field measurements;
    - 2. Field construction criteria;
    - 3. Catalog numbers and similar data.

- c. Coordinate each submittal with requirements of work and of contract documents.
- d. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect/Engineer's review of the submittals.
- e. Contractor's responsibility for deviations in submittals from requirements of contract documents is not relieved by Architect/Engineer's review of submittals, unless Architect/Engineer's deviations are identified by contract at time of submission.
- f. Notify Architect/Engineer's, in writing, at the time of submissions or deviations in submittals from requirements of contract documents.
- g. Begin no work which requires submittals until return of submittals with Architect/Engineer's stamp and initials or signature indicating review.
- h. After Architect/Engineer's review distribute copies, as needed.

6. Submission Requirements:

- a. Submittal schedule for shop drawings, product data, and samples shown:
  - 1. Date of Contractor's submittals;
  - 2. Date of Contractor's resubmittals;
  - 3. Date of approval;
  - 4. Date of release of work or purchase order.
- b. Schedule submissions at least fifteen (15) days before dates reviewed submittals will be needed.
- c. Submit number of samples specified in each of these specification sections.
- d. Accompany submittals with transmittal letter in duplicate, containing:
  - 1. Date;
  - 2. Project title and number, and contract number;
  - 3. Contractor's name and address;
  - 4. Number of each shop drawing, product data, and sample; and quantity of drawings submitted;
  - 5. Notification of deviations from contract documents;
  - 6. Other pertinent data.
- e. Submittals shall include:
  - 1. Data and revision dates;
  - 2. Project title and number;
  - 3. The names of:
    - a. Architect/Engineer
    - b. Construction Manager
    - c. Contractor
    - d. Subcontractor
    - e. Supplier
    - f. Manufacturer
    - g. Separate details, when pertinent.
  - 4. Identification of product or material;
  - 5. Relation to adjacent structure or materials;

6. Field dimensions, clearly identified as such;
7. Specification section numbers;
8. Applicable standards, such as ASTM number or Federal Specification;
9. Identification of deviation from contract documents;
10. Contractor's stamp, initialed or signed, certifying to review of submittal; verification of field measurements and compliance with contract documents.

7. Engineer's Review:

- a. Engineer's will review and stamp submitted shop drawings and other submissions in one (1) of the following ways:
  1. "NO EXCEPTIONS TAKEN": Submission is in full compliance with all contract documents, or indicated deviations are acceptable.
  2. "MAKE CORRECTIONS NOTED": Submission has minor corrections not significant enough to require resubmission; noted corrections must be made in the final installation.
  3. "REJECTED": Submission does not meet contract requirements; resubmission of shop drawings, which meet contract requirements, is required.
  4. "AMEND AND RESUBMIT": Resubmission is required due to the nature and/or number of corrections.
- b. Work shall be executed in accordance with "No Exception Taken" or "Make Corrections Noted" drawings only.
- c. Engineer's approval is for conformity to design requirements and arrangement only. Contractor is responsible for quantity, dimension, accuracy of fit, and coordination with other trades. Approval is subject to all contract requirements and does not authorize any changes involving additional costs, unless stated in a separate letter or change order.

8. Resubmission Requirements:

- a. Shop Drawings:
  1. Revise initial drawings, as required, and resubmit, as specified to initial submittal;
  2. Indicate on drawings any changes which have been made, other than those requested by the Engineer;
  3. Submit new product data and samples, as required on initial submission.

9. Distribution of Submittals After Review:

- a. Distribute copies of shop drawings and product data which carry Engineer's stamp to:
  1. Contractor's File;
  2. Job Site File;
  3. Record Document File;
  4. Sub-Contractors;
  5. Supplier;
  6. Fabricator.



- b. Distribute samples as directed; remove from site if so placed or incorporated in finished work when permitted by Architect/Engineer.

1.29 Schedule of Values:

1. Work Included:

- a. Submit to Construction Manager the Schedule of Values, within seven (7) days after award of contract.
- b. Upon request of Construction Manager, support values given with data that will substantiate their correctness.
- c. List quantities of materials specified under unit price allowances.
- d. Payment for materials stored on site will be limited to those materials listed in Schedule of Unit Material Values.
- e. Use Schedule of Values only as basis for Contractor's Application for Payment.

2. Submittals:

- a. Form and Content:
  - 1. Submit typewritten Schedule of Values on AIA G702a.
  - 2. Use Table of Contents of these specifications as basis for format of listing costs of work for sections under divisions applicable to contract.
  - 3. Identify each line item with section number and title, as listed in Table of Contents of these specifications.

3. Preparation:

- a. Itemize separate line item cost for each of the following general cost items:
  - 1. Insurance, performance, and payment bonds;
  - 2. Field supervision and layout;
  - 3. Temporary facilities and controls;
  - 4. Mobilization;
  - 5. Performance testing (not less than 10% of value of equipment/system being tested);
  - 6. Allowances.
- b. Payment for field supervision, layout, temporary facilities, and controls will be made monthly as a percentage of project completion corresponding directly to the percent of total dollar value of the work owed (does not include retainage).
- c. Itemize separate line item cost for work required by each section of these specifications.
- d. Provide line item for each major component of work for which contractor will require partial payment or where so requested by the Construction Manager.

4. Review and Submittal:

- a. After review by Architect/Engineer, Construction Manager, and Owner, revise and resubmit schedule, as required.
- b. Schedule of Value(s) which are "front-loaded" will be rejected.

1.30 Project Coordination: Wherever the term, "General Construction Contractor" is used herein, it is intended to mean either the Contractor for the General Construction whenever separate prime contracts are involved, or the Sole Contractor if there are no other prime contractors engaged on the project.

Wherever separate contracts are awarded to separate Prime Contractors for the different branches of the work, each Prime Contractor shall cooperate with the other trades to ensure that the work progresses as required by the contract documents, so that no portion of the work is delayed or not properly undertaken due to such lack or failure of cooperation. Each Prime Contractor shall have at least one (1) full-time Project Manager assigned to the project. The Project Manager shall attend each Progress Meeting at the site.

Contractors shall lay out and install their work at such time or times and in such manner as to facilitate the general progress of the project.

1.30.1 Items noted NIC (Not in Contract), will be supplied and installed by Owner

1.30.1.1 For Owner installed products, the Owner's responsibilities are as follows:

1. Provide reviewed shop drawings, product data, and samples, to the Contractor responsible for installation or coordination.
2. Provide product delivery to the site.
3. Arrange for manufacturers' warranties, inspections, and service.
4. Arrange for product installation.

1.30.1.2 For Owner installed products, the Contractor's responsibilities are as follows:

1. Review Owner provided shop drawings, product data, and samples for coordination purposes.
2. Receive and install product, if required by the Project Documents.
3. Notify the Owner of any discrepancies between the Contract Documents and the product which is to be provided.

1.31 Cut-Overs, Interruptions to Existing Buildings: All cut-overs of mechanical and electrical services to existing buildings shall be scheduled and coordinated in advance with the A/E and done at a time convenient to the Board of Education so as not to unreasonably interfere with its operations.

1.32 Control Wiring: The Prime Contractor who furnishes and installs mechanical equipment, including but not limited to heating, ventilating, and air conditioning systems; ATC systems; boilers, remote monitoring systems; and so forth, which systems require electrical control wiring, shall include the cost of all such control wiring and its installation in his proposal.

Control wiring must connect to a point of electrical power supply as shown in the contract documents. (Power wiring and supply shall be provided by the Electrical Contractor.)

1.33 Openings, Channels, Cutting and Patching: Refer to Specification Section 011200 – Special Provisions.

1.34 Grade Lines and Levels: The General Construction Contractor shall be responsible for locating and laying out the building and all its parts on the site, in strict accordance with the contract documents, and shall accurately establish and maintain dimensional control. He shall employ and pay for the services of a competent and licensed New York Engineer or Land Surveyor (who shall be approved by the A/E to perform all layout work, and to test the levels of elevations, footing base plates, columns, walls and floor and roof lines, and furnished the A/E as work progresses, certificates that each of such levels is as required by the contract drawings. The plumb lines of walls, etc. shall be tested and certified by the surveyor as the work progresses.

The Engineer or Surveyor, in his layout work, both on the site and within the building shall establish all points, lines, elevations, grades, and bench marks for proper control and execution of the work. He shall establish a single permanent bench mark as directed to which all three coordinates of dimensional control shall be referred. He shall verify all contract-furnished topographical and utility survey data and all points, lines, elevations, grades, and bench marks; should any discrepancies be found between information given on contract drawings and the actual site or field conditions, the General Contractor shall notify the A/E of such discrepancy, and shall not proceed with any work affected until receipt of written instructions from the A/E.

1.34.1 The General Construction Contractor will employ a Land Surveyor, registered in the State of New York and acceptable to Architect, to perform survey work of this section. Submit evidence of Surveyor's errors.

1.35 Regulatory Requirements: All general construction, plumbing, heating, and electrical work is to be done in accordance with the New York State Building Code. No work requiring inspections and approvals of construction code officials is to be covered or enclosed prior to inspection and approval by appropriate code enforcement officials.

Prior the start of any crane equipment operations, each contractor shall make all necessary applications and obtain all required permits from the Federal Aviation Administration (FAA). The sequence of operations, timing and methods of conducting the work shall be approved by the FAA to the extent that it relates to their jurisdiction.

1.36 Construction Progress Schedule: The contract shall be completed within the specified number of calendar days from the date a Notice to Proceed is issued.

Single Prime Project:

The Prime Contractor shall be responsible for preparing and furnishing to the Construction Manager/Architect for his approval, which must be approved, before submission of the first monthly estimate for payment, a Progress Schedule. The schedule shall be in the form of an arrow network diagram, bar chart, or other graphic Progress Schedule in sufficient detail to satisfy the Construction Manager.

Multiple Prime Project:

Each Prime Contractor shall be responsible for preparing and furnishing to the Construction Manager for his approval, which must be approved, before submission of the first monthly estimate for payment, a Progress Schedule. The schedule shall be in the form of an arrow network diagram, bar chart, or other graphic Progress Schedule in sufficient detail to satisfy the Construction Manager.

Each individual draft schedule shall be combined into a Single Coordinated Progress Schedule by the Construction Manager for final review and coordination with each Prime. Monthly estimates will not be processed by the Board of Education until and unless a single coordinated progress schedule shall have been submitted and approved.

The Progress Schedule based upon the contractor's logic and time estimates shall indicate in suitable detail for display, all significant features of the work of each contractor, including the placing of materials orders and anticipated delivery dates for long lead items, submissions and approvals of shop drawings, all work activities to be performed by each contractor and the beginning and time durations thereof and the dates of substantial and final completion of the various branches of the work.

Immediately upon such approval, the Construction Manager shall distribute the Progress Schedule to each Prime Contractor. The final coordinated Schedule shall be signed and dated by all the Prime Contractors involved.

Each Contractor shall furnish sufficient labor, construction plan, and equipment to insure the progress of the work in accordance with the Project Schedule. If the latest completion time for any significant job doesn't come within the time allowed by the Project Schedule, the sequence of the jobs and/or the time for performance of the jobs shall be revised through concurrent operations, additional manpower, additional shifts, overtime, etc., until it is assured that the Contract Completion Date will be met. No additional costs to the Board of Education will be allowed by the contractor(s) for overtime, additional manpower, equipment, additional shifts, etc. (except as may be provided elsewhere in the contract) if such expediting procedures or measures are necessary to meet the agreed completion date.

Each contractor agrees that he will make no claim for, and have no right to, additional payment or extension of time for completion of the work, or any other concession because of any interpretation or misunderstanding on his part of the Project Schedule and the manner in which it will be used on the project or because of any other contractor's failure properly to participate in the development of a schedule or to perform his contract in accordance with the schedule.

**1.37 Temporary Construction Facilities:** Each prime contractor will provide, on site, and maintain during the project construction, a suitable weather-tight insulated field office conveniently located for reception and continuous use and shall maintain therein a complete set of Contract Documents including plans, specifications, CPM network diagrams, change orders, logs, and other details and correspondence. The field office shall contain approved and safe heating facilities and lighting, convenience outlets, fire extinguisher, minimum of two operating windows of 15 SF each, outside door, handle, hasp, and padlock. The field office may be removed upon enclosure of the building at a time directed by the contractor; contents and operations will be transferred to the interior of the project building by the general contractor and said offices shall be maintained by the general contractor until final acceptance of the project.

**1.38 Temporary Water:**

1. The Plumbing Contractor shall provide, protect and maintain an adequately controlled (valve) water supply to a convenient location for the use of all Contractors on the project during the period of construction, either by means of the permanent water supply line, or by the installation of a temporary water supply line. The water supply line shall be made available within fifteen (15) days after the written request has been made to the Plumbing Contractor by any Contractor requiring this service. Copies of the request will be sent to the Architect/Construction Manager and the Owner.
2. Temporary water will be provided by the Owner at no charge to the Contractor provided and to the extent it may be existing and available at the site immediately prior to

commencement of and during construction. It is the obligation of any Prime Contractor requiring temporary facilities to investigate and make specific arrangements with the Owner for such facilities and to include in his proposal the cost of any additional facilities he may require for proper conduct of his Work.

3. The Plumbing Contractor is responsible to protect all water lines from damage or freezing, be they permanent or temporary. Should water connections be made to an existing line, the Plumbing Contractor shall provide a positive shut off valve at his cost and expense.
4. If the Plumbing Contractor fails to carry out his responsibility in supplying of the water, as set forth herein, he shall be held responsible for such failure, and the Owner shall have the right to take such action as he deems proper for the protection and conduct of the Work and may deduct the cost involved in so doing from any sums due the Plumbing Contractor.

#### 1.39 Temporary Light & Power:

1. Electrical Contractor shall extend electrical service to the building or buildings at locations approved by the Owner. Temporary electrical service shall be independent of the existing permanent service. Initial temporary service shall be three (3) phase or single phase depending upon closest availability to the project. Temporary light and power installations, wiring, and miscellaneous electrical hardware must meet the National Electric Code. This service shall be installed within fifteen (15) days after written request has been made to the Electrical Contractor by any Prime Contractor regarding such service (with copies to the Architect/Construction Manager and the Owner). When the Contract calls for three-phase permanent service, the Electrical Contractor shall install same within a reasonable time to permit use by any other prime contractors. Electrical characteristics shall be provided to meet all temporary light and power reasonably required as herein and hereafter specified or as included under Supplementary General Conditions. The Electrical Contractor shall provide the necessary distributing facilities and meter and shall pay the cost of running temporary services from the nearest utility company power pole. All costs shall be included in his bid.
2. The Electrical Contractor shall extend the service into the building and shall provide temporary receptacles and lighting as described hereinafter, and one (1) 5 H.P. 208 V, or 220 or 230 volts power outlet for each building and one separate power outlet for each Contractor for the proper conduct of this Work. Power outlets shall be fed independently of the temporary lighting system. Where service of a type other than herein mentioned is required, the Contractor requiring same shall install and pay all costs of such special service. The size and incoming service and main distribution switch and panel shall be sized as any service by NEC requirements.
3. The Electrical Contractor shall provide double sockets at a maximum of thirty (30) feet on centers in large areas. One socket shall contain a 150 watt lamp, and the other socket shall be a grounding type to accept a receptacle plug for small single-phase loads to be used for short periods of time. The Electrical Contractor shall provide double sockets of the type described above in all individual rooms, one (1) double socket for each 500 square feet or fraction thereof of room area (for example: a room 30' by 30' is equal to 900 square feet and would require two (2) double sockets).
4. The Electrical Contractor shall provide all electrical service for operation of elevator equipment during construction, as well as for permanent installation.



5. The General Construction Contractor shall pay for cost of all electric energy used on distribution lines installed by the Electrical Contractor until the project is accepted by the Owner. The Electric Contractor shall provide and pay for all maintenance, servicing, operation and supervision of the service and distribution facilities. He shall also connect, maintain, and service any electrical equipment installed by the Mechanical Contractor which may be necessary for maintaining heat whenever heat is required in the building whether from the temporary or permanent system.
6. Any Contractor who fails to carry out his responsibility in the supplying of uninterrupted light and power or other utility as set forth herein, shall be held responsible for such failure, and the Owner shall have the right to take such action as he deems proper for the protection and conduct of the work and shall deduct the costs involved from the amount due the Contractor at fault.
7. There shall be no additional cost to the Owner or other Prime Contractors because of standby requirements due to conflict in the normal working hours of the various trades. The Electrical Contractor shall provide temporary light and power to all trades during normal working hours of such trades. Where overtime work by any Contractor necessitates standby electricians or other trades, such Contractor shall be responsible for making appropriate arrangements, financial and otherwise, for such service at no cost to the Owner.
8. The Electrical Contractor shall observe the requirements of the Federal Occupational Safety and Health Act of 1970 with regard to temporary light and power.

1.40 Temporary Heat:

1. Prior to the building being enclosed by walls and roof, if the outside temperatures shall fall below 40°F, at any time during the day or night, and heat is required for work in progress or for its protection, the respective Contractors responsible for such phase of work shall furnish, at their expense, acceptable means to provide sufficient temporary heat to maintain a temperature of not less than 45°F for that portion of the work for which they are directly responsible.
2. Heating of field office, storage spaces, concrete and masonry materials and working area heating, as required, shall be provided by the responsible Contractors.
3. As soon as the Owner determines that the building or a major unit thereof is "generally enclosed" by walls and the roof, the responsibility of supplying working area heat shall rest with the General Construction Contractor. When the outside temperature falls below 40°F at any time during the day or night, the General Construction Contractor shall furnish sufficient heat by the use and maintenance of PL gas heaters or other acceptance means to maintain a temperature of not less than 45°F within the enclosed area of the building at all times and shall remove when no longer required. The General Construction Contractor will be held responsible for providing temporary heat for damages, as a result of freeze-ups, for a period which will extend sixty (60) days beyond the date of which the Owner determines that the building is temporarily enclosed (without the use of temporary enclosures or materials except in circumstances having the prior written approval of the owner). He shall remove soot, smudges, and other deposits from walls, ceilings, and all exposed surfaces, which are the result of the use of heating equipment, including the permanent heating system, during the period of its use for supplying heat. He shall not do any finish work until the areas are properly cleaned. The general Construction Contractor shall provide or arrange, at his expense, supervision of the heating equipment at all times which obligations shall commence sixty (60) days after the acknowledged permanent enclosure of the building or buildings, as confirmed by the

Owner. The General Construction Contractor shall furnish and pay for all fuel for heat required during the entire construction period.

4. The General Construction Contractor shall not assume that the permanent heating system or any part thereof will be available for furnishing of temporary heat during the period for which temporary heat is the responsibility of the General Construction Contractor. The General Construction Contractor's base bid price shall therefore include the cost of all equipment necessary for providing temporary heat as required under these specifications.
5. All heating equipment shall be NFPA approved and connected to approved flues to the atmosphere. Gas cylinders within the building shall not exceed 100 lbs. capacity, shall have interstate Commence Commission approval and shall be fitted with a permanent cap to protect the valve when not in use. Heaters shall be approved by a recognized testing laboratory and must be equipped with a positive shut-off safety valve. Cylinders and heaters shall stand at least 6 feet apart and be connected with two (2) braid neoprene hoses that will withstand 250 PSI test pressure.
6. Storage of cylinders within the building will not be permitted at any time. Fire extinguishers shall be provided by the General Construction Contractor on each floor where heaters are used, and the areas must be adequately ventilated.
7. Contractors responsible for providing temporary heat shall train at least two (2) dependable persons to oversee temporary heat operations.
8. For the purposes of establishing the beginning of the General Construction Contractors obligation to provide temporary heat, a building, or major unit thereof, shall be considered generally enclosed when (a) the exterior walls have been erected; (b) a temporary roof or permanent roof is installed and in watertight condition; (c) temporary or permanent doors hung and window openings are closed with either permanent or temporary weather-tight enclosures (cardboard or woven materials are not to be used; however, any impervious transparent material responsibly intended for such purpose is acceptable). A major unit of buildings as referred to herein shall be: (1) an entire separate structure, or (2) a fully enclosed wing which shall have a floor area equal to at least fifty percent (50%) of the total floor area of the project.
9. When the building or a major unit, including the boiler room area, is GENERALLY enclosed as herein defined and appropriate notice has been given, it shall be the obligation of the Owner, or his authorized representative, to so acknowledge at a job conference at the site. The minutes of said meeting shall contain acknowledgment. If the Architect/Engineer and the Owner concur that the building or major unit is properly GENERALLY enclosed, then at the date of the job conference at which notice was given, the supply of heat (INCLUDING COST OF FUEL) and the payment of cost of repair of damage created by freeze-up shall become the responsibility and obligation of the General Construction Contractor. Confirmation of the time that such responsibility and obligation becomes effective shall be incorporated in the minutes of the job conferences, as prepared by the Architect/Engineer. Copies of the minutes shall be sent to all Contractors engaged in the project, who shall give due attention to their obligations in this connection.
10. The General Construction Contractor shall continue to provide acceptable means of heat until the building is completed and the water systems have been drained down. The fuel shall be paid for by the General Construction Contractor regardless of who provides and maintains the heat of equipment.

11. The Owner reserves the right to permit the substitution of limited temporary enclosures in lieu of permanent construction for the attainment of a permanently tight building if such action is deemed by the Owner to be in the best interest of the project.

This action will not be such as to create future jeopardy to the environmental integrity of the building as construction proceeds.

#### 1.41 Reserved.

1.42 Temporary Toilet Facilities: The General Construction Contractor shall provide and pay for suitable temporary toilets, at an approved location on the site, prior to the start of any field work. They shall comply with State and Local laws. The General Construction Contractor will be responsible for maintenance, removal and relocation as described hereinafter.

Toilets shall be of the portable, chemical type, mounted on skids, with screened enclosures with doors, each having a urinal and water closet.

Each unit shall be serviced at least twice a week, including removal of waste material, sterilizing, recharging tank, refilling tissue holders, and thorough cleaning and scrubbing of entire interior which shall be maintained in a neat and clean condition.

Relocate facilities inside building and connect to water and sewer as soon as work will allow.

When toilets are connected to water and sewer lines, take precautions to preventing freezing.

Remove units from the site at completion of work when directed.

Workmen are NOT to use the finished bathroom and toilet facilities in the project buildings (reasonable steps must be taken by the General Construction Contractor to enforce this rule).

1.43 Temporary Enclosures: Whenever necessary, in order to maintain proper temperatures for the execution of the work, or for the protection thereof, the General Construction Contractor shall furnish and maintain temporary enclosures for all openings in exterior walls that are not enclosed with finishing materials. Temporary wood doors shall be provided at door openings.

#### 1.44 Protection of Work and Property:

1. Safety Precautions and Programs: Each prime contractor shall be responsible, in cooperation and in coordination with the General Contractor, for initiating, maintaining, and supervising all safety precautions and programs in connection with the prime contractor's work. He shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated by the contractor in writing to the Construction Manager.
2. Safety of Persons and Property: Each prime contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:
  - a. Every employee on the work and all other persons who may be affected thereby;

- b. All the work and all the materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the contractor or any of his subcontractors, or lower tier subcontractors; and
- c. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

The contractor shall give all notices in writing, and comply with all applicable laws, ordinances, rules, regulations, lawful orders and implementing guidance of any governmental entity, agency, or public authority bearing on the health or safety of persons or property or their protection from damage, injury or loss.

The contractor shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including rails, night-lights, the posting of danger signs, and other warnings against hazards, promulgating safety regulations, notifying owners and users of adjacent utilities and other means of protection against accidental injury or damage to persons or property.

When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution for the work, the contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

No contractor shall load or permit any part of the work to be loaded so as to create a safety hazard.

The contractor shall promptly remedy all damage or loss to any property caused in whole or in part by the contractor, any of his subcontractors, sub-subcontractors, suppliers, or anyone directly employed or engaged by any of them, or by anyone whose acts any of them may be liable and for which the contractor is responsible. The foregoing obligations of the contractor are in addition to his obligations as stated elsewhere herein.

1.44.1 The Owner may maintain security for their sole benefit. It is the responsibility of the Contractor to provide security and or protection of their work until the Owner accepts such work.

1.44.2 The Contractor is responsible for the furnishing, installation, maintenance and removal of safety, fall and opening protection, etc., associated with their work. The Contractor shall furnish, install, maintain and remove all perimeter protection cable in full compliance with OSHA standards at all elevated areas, including the roof level.

1.44.3 The Contractor is responsible for the removal and immediate replacement, at the conclusion of their work, of all temporary protection measures as required in order to facilitate their work. No fall or opening protection shall be removed until the progress of the permanent work is installed in a manner that results in no hazard to any party.

1.44.4 The installation of all barricades, enclosure, temporary partitions and other protective measures shall be performed in full compliance with the requirements of the New York State Department of Labor, OSHA regulations and all other applicable Federal, State and Local laws.

1.45 Emergencies: In any emergency affecting the safety of persons or property, the contractor shall act with diligence, at his discretion, to prevent threatening injury, damage, or loss. In such case, he shall immediately notify the Board of Education and Construction Manager of the action taken and shall forthwith prepare and submit a detailed and documented report to the Board of Education and Construction Manager.

Wherever the contractor has taken no action but has notified the Board of Education and the Construction Manager or wherever the Board of Education and Construction Manager has otherwise been made aware

of any emergency threatening injury to persons, or loss or damage to the work, or to adjacent property, the contractor shall act only as instructed or authorized by the Board of Education or Construction Manager.

**1.46 Temporary Drives, Walks, and Parking Areas:** The General Construction Contractor shall be responsible for keeping all roadways, drives, and parking areas within or proximate to the site free and clear of debris, gravel, mud, or any other site materials by insuring that all measures reasonably necessary are taken to prevent such materials from being deposited on such surfaces including, as may be appropriate, the cleaning of vehicle wheels, etc. prior to their leaving the construction site. Should such surface require cleaning, the General Construction Contractor will clean these surfaces without additional cost to the Board of Education. The General Construction Contractor will be held accountable for any citations, fines, or penalties imposed for failure to comply with local rules and regulations.

Should the General Construction Contractor elect to commence construction of permanent driveways, parking areas, or walks, other than general grading of temporary shop areas, he shall not do so without the approval of the A/E. He shall not do so without having prepared the subgrade, as may be elsewhere required by the Specifications, nor will he be relieved from any responsibility for providing additional materials or of reworking the subgrade prior to completion, if so required to make the improvements conform fully with the specifications.

**1.47 Temporary Controls:**

1. Dust Control - The General construction Contractor, at his expense, shall provide and maintain necessary temporary dustproof partitions around areas of work in any existing building or in new building areas as directed by the Construction Manager.
2. Pollution Control - All sewage disposal work shall conform with the regulations of the State of New York Department of Environmental Protection.
3. Erosion Control - Soil conservation measures are to be in accordance with the Soils Conservation District requirements.
4. Haul Routes:
  - a. The General Construction Contractor shall be responsible for providing and maintaining unobstructed traffic lanes on the designated Construction Access Routes either shown on the contract drawings or reasonably required so as to perform the work and shall provide and maintain all reasonable required safety devices. He shall provide the addition of material, their grading and compaction, the removal of snow and debris so as to provide and maintain the general serviceable condition of the access roadbed, as well as pedestrian ways.
  - b. The General Construction Contractor shall obtain permission, in writing, from the A/E before using any existing driveway or parking areas not specifically designated for such use in the Contract Documents for construction purposes. He shall maintain such driveways and areas in good condition during the construction period, and completing of the project, shall leave them in the same condition as the start of the work. Conditions before use should be carefully photographed or documented by the Contractor.

**1.48 Testing of Mechanical and Electrical Systems:** When mechanical, electrical, or other equipment is installed, it shall be the responsibility of the installing Contractor to operate it for such period of time as may be required for the proper inspecting and testing of the equipment and for instructing the Board of



Education's operating personnel. All tests shall be conducted in the presence of, and upon timely notice (three (3) working days) to the A/E prior to acceptance of the installation.

If the Architect/Engineer determines that any work requires special inspection, testing or approval, not otherwise required herein, he will, instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give a three (3) work day notice. If such special testing or inspection reveals a failure of the work to comply with the requirements of the Contract, the Contractor shall bear all costs thereof.

1.49 Final Clean Up: In addition to those responsibilities addressed in the General Conditions, the Contractor shall:

1. Remove all debris and rubbish resulting from or relating to his work. Rubbish shall not be thrown from building openings above the ground floor unless contained within chutes;
2. Remove putty stains from glass and mirrors; wash and polish inside and outside;
3. Remove marks, undesirable stains, fingerprints, other soil, dust or dirt from painted, decorated or stained woodwork, plaster or plasterboard, metal acoustic tile and equipment surfaces;
4. Remove spots, paint and soil from resilient, glazed and unglazed masonry and ceramic flooring and wall work;
5. Remove temporary floor protections, clean, wash or otherwise treat and/or polish, as directed, all finished floors;
6. Clean exterior and interior metal surfaces, including doors and window frames and hardware of oil stains, dust, dirt, paint and the like, polish where applicable and leave without fingerprints or blemishes; and
7. Restore all landscaping, roadway and walkways to preexisting condition. Damage to trees and plantings shall be repaired in the next planting season, and such shall be guaranteed for one year from date of repair and/or replanting.

1.50 Reserved:

1.51 Permits: Construction permits have been issued to the owner. The owner will forward a copy to the Contractor and Construction Manager so that they can be posted before any work can begin.

1.52 Possible Asbestos Containing Materials: There may be some areas where asbestos containing building materials may exist (i.e. floor tile, plaster walls, ceiling tile, etc.) and could possibly be disturbed during construction of this project. The contractor shall review the Asbestos Management Plan for each building before any construction starts. The Asbestos management Plan is located at the main office of each school and identifies areas where asbestos containing building materials are located. Should there be an area where asbestos containing building materials must be disturbed, the contractor shall notify the Owner immediately. Do not start work. Asbestos material disturbance will be addressed by the Owner, unless the removal is specifically included in the scope of work of this contract.

1.53 Lead Base Paint: All contractors shall be made aware that some of the walls and ceilings that are painted and are required to be disturbed may contain lead base paint. The contractor shall follow safe

work practices with regard to removing any lead based paint from these areas. Please refer to Section 02831 for General Procedures required for any activities that would affect the lead based paint.

Pursuant to 40 CFR Part 745, all firms performing renovation, repair and painting projects in target housing must be certified with the EPA to conduct lead-based paint activities and/or renovations prior to disturbing any areas where lead-based paint has been identified, or where the painted surface(s) has not already been determined to be lead free by an EPA-certified lead inspector/risk assessor.

1.54 Use and/or Storage of "Hazardous Substances": The contractor is to notify the owner of any "Hazardous Substances" to be used/stored on site during construction at the Pre-Construction Meeting. This notification shall include a "Hazardous Substances Fact Sheet" as prepared by the Department of Health and Senior Services.

Should the need for the use of a hazardous substance arise during construction, the contractor is to utilize the following procedure:

1. If the school is occupied, notice is to be given to the owner of the need for a hazardous substance a minimum of two (2) weeks prior to its arrival on site. A "Hazardous Material Fact Sheet" is to be submitted at that time for each substance to be used. Also, a notice indicating the type(s) of hazardous substance(s) to be used is to be posted within the school a minimum of two (2) days prior to its arrival on site.
2. If the school is not to be occupied within 24 hours of use, notice is to be given to the owner and a notice posted within the school (as per the description above) a minimum of two (2) days prior to the arrival of hazardous substances on site.

The above procedures are as per Act No. 246 of the State of New York, PL 1997, c.364.

1.55 Uniform Safety Standards for School Construction & Maintenance Projects:

1. "The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a Certificate of Occupancy."
2. Indication that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos. Note, the project folder should contain a letter regarding the presence of asbestos.
3. "General Safety and security standards for construction projects."
  - a. All construction materials shall be stored in a safe and secure manner.
  - b. Fences around construction supplies or debris shall be maintained.
  - c. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
  - d. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
  - e. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites."

4. "Separation of construction areas from occupied spaces. Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust, or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
  - a. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs, or elevators designated for students or school staff.
  - b. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
  - c. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session."
5. A plan detailing how exiting required by the applicable building code will be maintained is not applicable for this project.
6. A plan detailing how adequate ventilation will be maintained during construction is not applicable for this project.
7. "Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken."
8. "The contractor shall be responsible for the control of chemical fumes, gases, and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes."
9. "The contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers recommendations before a space can be occupied."
10. "Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied." Note, it is our interpretation that the term "building", as referenced in this section, means a wing or major section of the building that can be completely isolated from the rest of the building with sealed noncombustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.

Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

11. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturbed surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, work site preparation, work methods, cleaning and clearance testing which are in good accordance with the HUD Guidelines.

END OF SECTION 010000





**TABLE 1-1**

**LIQUIDATED DAMAGES**

**MAMARONECK UNION FREE SCHOOL DISTRICT**

Contract No's.	Description	Contract Start Date	Construction Start Date	Construction Completion Date	Liquidated Damages \$/Calendar Day
#3a-d	Capital Improvements at Chatsworth Avenue School	Notice to Proceed	June 29, 2021	See Spec. Section 011200 for Milestone Schedule	\$1,000.00



## SECTION 010101 – MULTIPLE CONTRACT SUMMARY

### PART 1 – GENERAL

#### 1.01 RELATED DOCUMENTS

- A. This summary is provided as a reference for the bidders. However, such summary shall not relieve the bidder of its obligation to review the contract documents for a complete picture of the work and the requirements that must be adhered to in the performance of the work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Capital Improvements at Chatsworth Ave. School
  - 1. Project Location: 34 Chatsworth Avenue, Larchmont, NY 10538
  - 2. Owner: Mamaroneck Union Free School District.
- B. Architect Identification: The Contract Documents, dated January 10, 2020 were prepared for Project by LAN Associates, 252 Main Street, Goshen, NY 10924
- C. Construction Manager: Triton Construction, 1279 Route 300 1st Floor , Newburgh, NY , 12550 has been engaged as Construction Manager for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.
- D. The Work consists of the construction of various capital improvements for the Mamaroneck Union Free School District.
  - 1. The Work includes, but is not limited to, sitework, architectural, structural, masonry asbestos & lead, foundations, interior walls, floor and ceiling finishes; windows and doors; casework, mechanical, electrical and plumbing work as shown in the Contract Documents.
  - 2. All materials, assemblies, forms and methods of construction and service equipment shall comply with the requirements of the latest edition of the New York State Building Code.

#### 1.03 CONTRACTOR'S DUTIES

- A. Except as specifically noted, provide and pay for:
  - 1. Labor, materials, and equipment;
  - 2. Tools, construction equipment, and machinery;
  - 3. City water, heat, utilities, etc. required for construction;
  - 4. Other facilities and services necessary for proper execution and completion of work.
- B. Secure and pay for, as necessary, proper execution and completion of work, and as applicable, at time of receipt of bids:
  - 1. Permits;
  - 2. Government Fees;

3. Licenses;
  4. Inspections of all work.
- C. Give required notices to all governmental agencies and utilities;
- D. Comply with laws, codes, ordinances, regulations, rules, orders, and other legal requirements of any governmental entity, agency, or public authorities which bear on the performance of work.
- E. Promptly submit written notice to Engineer of observed variance of Contract Documents from legal requirements:
1. This observation should be presented prior to award of contract.
  2. Appropriate modification to Contract Documents will adjust necessary changes;
  3. Assume responsibility for work known to be contrary to such requirements when above notice has not been given.
- F. Owner is exempt from sales tax:
1. Obtain sales tax exemption certificate from Owner;
  2. Put exemption certificate number on invoices for material incorporated in work;
  3. Upon completion of work, file with Owner notarized statement that all purchase made under exemption certificate were entitled to be exempt;
  4. Pay legally assessed penalties for improper use of exemption certificate number.

#### 1.04 DRAWINGS INCLUDED IN CONTRACT DOCUMENTS

- A. Refer to List of Drawings located on Title Sheet of the Drawings.

#### 1.05 CONTRACTS

- A. The owner will award the following Construction Contracts for the Project in order to complete all work as indicated and specified:
- Contract 3a General Construction Contract
  - Contract 3b Mechanical Contract
  - Contract 3c Plumbing Contract
  - Contract 3d Electrical Contract
- B. In each case, the Contractor agrees to accept the site, as it exists and to remove any encumbrances, which interfere with proper fulfillment of the Work, without change in the Contract Sum.
- C. Accommodate the Owner's intention to continue occupancy in the existing building, including site and to conduct normal school operations during the time of construction of the work.
1. Cooperate with the Owner's personnel in maintaining and facilitating access to the school building and its facilities by school personnel, school staff, and the public, while construction is still in progress.
  2. Emergency access at driveways and building entrances: Keep driveways and entrances serving the occupied school building clear and available to the Owner, the Owner's employees and the public, and to emergency vehicles at all times. Do not obstruct access to these areas or use such areas for parking, construction equipment or storage of materials.

3. Schedule construction operations so as to minimize conflicts with and interruptions to daily school function. Coordinate necessary interruptions with Owner's personnel.
  4. The existing building must remain operational at all times, therefore the Contractors are responsible to maintain all systems such as but not limited to fire alarm, clocks, public address system, electric, gas services, heat, etc.
- D. The Contractor shall cooperate with separate Contractors for any separate Contracts that the Owner may award. This includes other prime contracts of this project as well as any other contracts the owner awards that may be occurring simultaneous to this project.

#### 1.06 MULTIPLE PRIME CONTRACTS

- A. The Project will be constructed under a multiple prime-contracting agreement. Prime Contracts are separate contracts between the Owner and separate contractors, representing significant construction activities. Each prime contract is performed concurrently with and closely coordinated with construction activities performed on the Project under other prime contracts. Prime Contracts for this Project include:
- Contract 3a General Construction Contract
  - Contract 3b Mechanical Contract
  - Contract 3c Plumbing Contract
  - Contract 3d Electrical Contract
- B. Contract Documents indicate the work of each prime Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessary limited to, the following:
1. Phasing
  2. Existing site conditions
  3. Alternates
  4. Allowances
  5. Miscellaneous Steel to be done by **Contact 3a – General Construction (GC).**
  6. GC is responsible for reviewing MEP drawings in order to quantify lintels and other openings requiring miscellaneous steel support. The work also includes the removal of any and all materials in order to install the steel as well as to create the clear opening required.
  7. Mechanical Contract, Plumbing Contract & Electrical Contract will be responsible to mark-out all locations for the GC.
  8. Firestopping
  9. Final Cleanup (All Contracts are responsible for their final cleanup.)
  10. Each Prime Contractor shall refer to specification Section 011200 – Special Provisions for Specific Scope Requirements for each Prime Contractor.

#### 1.07 CONTRACT 3a – GENERAL CONSTRUCTION

- A. **Contract 3a -General Construction** includes Architectural, civil, Structural, plus other construction operations traditionally recognized as General Construction. General Construction Contractor is responsible to coordinate all primes tasks. It also includes administrative and coordination responsibilities. Work under this prime Contract includes, but is not limited to, the following:



DIVISION 00 & 01 GENERAL REQUIREMENTS  
All of Division 00 & 01

DIVISION 2 – EXISTING CONDITIONS

02 41 19	Selective Demolition
02 41 20	Site Demolition
02 82 00	Asbestos Abatement Procedures

DIVISION 3 – CONCRETE

03 05 05	Under Slab Vapor Barrier
03 15 13	Waterstops
03 30 00	Cast-in-Place Concrete
03 40 00	Precast Concrete Hollow Core Slabs
03 54 00	Concrete Underlayment Patch
03 54 16	Cement-Based, Interior, Self-Leveling Underlayment

DIVISION 4 – MASONRY

04 01 10	Masonry Cleaning
04 01 20	Unit Masonry Restoration
04 01 22	Stone Restoration
04 21 13	Brick Masonry
04 22 00	Concrete Unit Masonry
04 72 00	Cast Stone Masonry

DIVISION 5 – METALS

05 12 00	Structural Steel Framing
05 31 00	Steel Decking
05 40 00	Cold Formed Framing
05 50 13	Miscellaneous Structural Fabrications
05 51 00	Metal Stairs and Railings
05 51 33	Metal Ladders

DIVISION 6 – WOOD AND PLASTICS

06 10 00	Rough Carpentry
06 10 53	Miscellaneous Rough Carpentry
06 20 00	Finish Carpentry
06 61 16	Solid Surfacing Fabrications

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 21 00	Building Insulation
07 21 13	Continuous Insulation
07 27 26	Air Barriers
07 56 00	Fluid Applied Roofing
07 57 13	Spray Polyurethane Foam Roofing
07 62 00	Sheet Metal Flashing and Trim
07 71 00	Manufactured Roof Specialties

07 81 00	Spray Applied Firestopping
07 81 23	Intumescent Firestopping
07 84 43	Firestopping
07 90 00	Pre-Compressed Expansion Joints
07 92 00	Joint Sealants
07 95 13	Interior Expansion Cover Assemblies

#### DIVISION 8 – OPENINGS

08 11 13	Hollow Metal Doors and Frames
08 14 16	Flush Wood Doors
08 17 43	Colonial Wood Grain FRP/Aluminum Hybrid Door
08 31 00	Floor Access Doors
08 31 13	Access Doors and Frames
08 51 13	Aluminum Windows
08 71 00	Door Hardware
08 81 00	Glass and Glazing
08 81 17	Fire-Rated Glass
08 90 00	Louvers and Vents

#### DIVISION 9 – FINISHES

09 05 61	Water Vapor Emission Control System for Concrete Slabs
09 29 00	Gypsum Board
09 30 19	Porcelain Wall Tile
09 51 13	Acoustical Tile Ceilings
09 65 13	Resilient Base and Accessories
09 65 14	Stair Landings, Risers, Treads and Ramps
09 65 19	Vinyl Tile Flooring
09 65 20	Resilient Solid Vinyl Tile
09 67 23	Resinous Flooring
09 68 13	Carpet Tile
09 84 39	Acoustical Ceiling Clouds
09 91 13	Exterior Painting
09 91 23	Interior Painting
09 93 00	Staining and Transparent Finishing
09 96 00	Elastomeric Coatings over Cement Board
09 96 10	High-Performance Wall Coatings
09 96 30	Elastomeric Coatings
09 96 46	Intumescent Painting

#### DIVISION 10 – SPECIALTIES

10 11 00	Visual Display Boards
10 12 00	Display Cases
10 14 19	Interior Signs
10 44 00	Fire Protection Specialties

#### DIVISION 11 – EQUIPMENT

11 40 00	Food Service Equipment
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DIVISION 12 – FURNISHINGS

12 21 24	Manual Roller Shade System
12 35 54	Manufactured Casework
12 48 40	Entrance Mats and Grates

DIVISION 14 – CONVEYING EQUIPMENT

14 21 00	Electric Traction Elevators
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DIVISION 31 – EARTHWORK

31 00 00	Earthwork
31 10 00	Site Clearing
31 20 00	Earth Moving
31 23 19	Dewatering – NY
31 31 17	Soil Conservation – NY
31 50 00	Excavation Support and Protection

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 16	Asphalt Paving
32 13 13	Concrete Paving
32 16 14	Concrete Site Work
32 17 23	Pavement Markings
32 31 13	Chain-link Fences and Gates
32 32 15	Precast Modular Block Gravity Retaining Wall
32 33 00	Signs – NY
32 92 00	Turf and Grasses
32 93 00	Plants

DIVISION 33 – UTILITIES

33 05 00	Common Work for Utilities
33 31 00	Sanitary Sewer – NY
33 39 00	Sanitary Utility Sewerage Structures
33 41 00	Storm Drainage

- B. The following additional requirements and responsibilities for the **Contract 3a - General Construction** include, but not limited to the following:

1. Refer to specification 011200- Special Provisions for additional requirements.
2. Temporary site protection and fencing.
3. All blocking and in walls for use by other trades. Other trades shall identify the locations of required blocking.
4. Blocking where necessary for installation of work under the contract for general construction.
5. Furnish and install all slotted grilles adjacent to convection radiation, including in walls and casework.
6. Winter Conditions: Snow plowing/shoveling all building areas exposed to weather, including access to the staging areas.
7. Steel stud framing for all walls, interior and exterior.
8. Concrete plank building structure and CMU bearing walls.

9. Interior finishes including but not limited to flooring, gypsum board, ceilings, tile, etc.
10. Furnish all dumpsters for building construction, for use by all trades and ensure proper disposal of all materials.
11. Install access panels/doors supplied by other trades.
12. Floor leveling in new construction.
13. Dewatering facilities and drains.
14. Fire Protection specialties including fire extinguishers and cases.
15. Install sleeves and other materials provided by other Contracts. Coordinate location of material installation with other Contractors.
16. Protection of work after installation.
17. Fire and smoke stopping/sealing.
18. Interior floor, wall and ceiling expansion joints as per the contract documents.
19. Framing for all soffits, interior and exterior.
20. All Interior architectural woodwork.
21. Foundation drains installation and tie into storm system.
22. Damp proofing and drainage board at foundations.
23. All louvers, casework and interior millwork.
24. Removal and disposal of fill in a legal manner.
25. Sidewalks, curbs, concrete pads and pavers.
26. Site excavation, bedding/concrete encasement and backfill by GC.
27. Housekeeping pads.
28. Construction of sidewalk sheds/bridges.
29. Temporary Heat: as required to execute Exterior Masonry work, Interior work and Interior finishes, as noted in Section 01 50 00 Temporary Facilities and Controls.
30. Each contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule.

#### 1.08 CONTRACT 2b – MECHANICAL

- A. **Contract 3b – Mechanical** includes heating, ventilation, and air conditioning system and the temperature control system. Work under this prime Contract includes, but is not limited to, the following:

##### DIVISION 00 & 01 GENERAL REQUIREMENTS

##### DIVISION 02 EXISTING CONDITIONS

- |          |  |
|----------|--|
| 02 41 19 | Selective Demolition (as it pertains to mechanical work) |
| 02 41 20 | Site Demolition (as it pertains to mechanical work)      |

##### DIVISION 3 – CONCRETE

- |          |  |
|----------|--|
| 03 05 05 | Under Slab Vapor Barrier (as it pertains to mechanical work) |
| 03 30 00 | Cast-in-Place Concrete (as it pertains to mechanical work)   |

##### DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- |          |  |
|----------|--|
| 07 84 43 | Firestopping (as it pertains to mechanical work)   |
| 07 92 00 | Joint Sealants (as it pertains to mechanical work) |

DIVISION 8 – OPENINGS

08 31 13 Access Doors and Frames (as it pertains to mechanical work)  
08 90 00 Louvers and Vents (as it pertains to mechanical work)

DIVISION 11 – EQUIPMENT

11 40 00 Food Service Equipment (as it pertains to mechanical work)

DIVISION 14 – CONVEYING EQUIPMENT

14 21 00 Electric Traction Elevators (as it pertains to mechanical work)

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 00 00 Mechanical Summary of Work  
23 01 30 Existing HVAC Air Duct Cleaning  
23 05 00 Common Work Results for HVAC  
23 05 13 Common Motor Requirements for HVAC Equipment  
23 05 19 Meters and Gages for HVAC Piping  
23 05 23 General-Duty Valves for HVAC Piping  
23 05 29 Hangers and Supports for HVAC Piping and Equipment  
23 05 48 Mechanical Vibration and Seismic Controls  
23 05 53 Mechanical Identification  
23 05 93 Testing, Adjusting, and Balancing for HVAC  
23 07 13 Duct Insulation  
23 07 14 Acoustic Duct Insulation  
23 07 19 Piping Insulation  
23 09 23.11 Direct Digital Controls System for HVAC  
23 09 93 Sequence of Operations for HVAC  
23 21 13 Hydronic Piping  
23 21 16 Hydronic Piping Specialties  
23 23 00 Refrigerant Piping  
23 31 13 Metal Ducts  
23 33 00 Air Duct Accessories  
23 34 16 Centrifugal HVAC Fans 1  
23 35 33 Listed Kitchen Ventilation System Exhaust Ducts  
23 37 13 Diffusers, Registers and Grilles  
23 38 13 Commercial-Kitchen Hoods  
23 72 00 Energy Recovery Ventilators  
23 74 13 Packaged Rooftop HVAC Units  
23 81 19 Self-Contained Air Conditioners  
23 81 26 Split-System Air – Conditioners  
23 82 23 Unit Ventilators  
23 82 36 Finned-Tube Radiation Heaters  
23 82 39 Cabinet Unit Heaters

B. The following additional requirements and responsibilities for the **Contract 3b - Mechanical** include, but not limited to, the following:

1. Refer to specification 011200- Special Provisions for additional requirements.
2. Removal and proper disposal of all debris.
3. Supply access panels/doors to be installed in walls, floors or ceilings to General Contractor for General Construction-Contract 3a to install.



4. Provide all excavation and backfill for trenches inside building walls associated with their work.
5. Provide starters to Electrical Contractor, installation to be by Electrical Contractor-Contract 3d.
6. Protection of work after installation.
7. Mechanical connections to equipment furnished by any other Contract.
8. Coordination Drawings, coordinate with Plumbing Contract and Electrical Contract.
9. Low voltage wiring for HVAC systems.
10. Trades shall identify the locations of required blocking for installation by General Contractor-Contract 3a.
11. Firestopping and sealing.
12. Temporarily remove, carefully store and reinstall existing hung ceiling panel assembly as required to access areas of work within plenum.
13. Each contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule.

#### 1.09 CONTRACT 3c – PLUMBING

- A. **Contract 3c – Plumbing** includes plumbing equipment, accessories and piping systems. Work under this prime Contract includes, but is not limited to, the following:

##### DIVISION 00 & 01 GENERAL REQUIREMENTS

##### DIVISION 02 EXISTING CONDITIONS

- 02 41 19 Selective Demolition (as it pertains to plumbing work)
- 02 41 20 Site Demolition (as it pertains to plumbing work)

##### DIVISION 3 – CONCRETE

- 03 05 05 Under Slab Vapor Barrier (as it pertains to plumbing work)
- 03 30 00 Cast-in-Place Concrete (as it pertains to plumbing work)

##### DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 07 84 43 Firestopping (as it pertains to plumbing work)
- 07 92 00 Joint Sealants (as it pertains to plumbing work)

##### DIVISION 8 – OPENINGS

- 08 31 13 Access Doors and Frames (as it pertains to plumbing work)

##### DIVISION 11 – EQUIPMENT

- 11 40 00 Food Service Equipment (as it pertains to plumbing work)

##### DIVISION 14 – CONVEYING EQUIPMENT

- 14 21 00 Electric Traction Elevators (as it pertains to plumbing work)

## DIVISION 21 – FIRE SUPPRESSION

21 05 29	Pipe Hangers and Supports
21 13 00	Sprinkler and Standpipe Piping
21 13 13	Sprinkler Systems

## DIVISION 22 – PLUMBING

22 00 00	Plumbing Summary of Work
22 05 01	Basic Plumbing Materials and Methods
22 05 19	Meters and Gages for Plumbing Piping
22 05 23	Plumbing Valves
22 05 29	Hangers and Supports for Plumbing and Piping Equipment
22 05 48	Vibration and Seismic Controls
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 11 23	Facility Natural-Gas Piping
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 13 23	Sanitary Waste Interceptors
22 14 13	Facility Storm Drainage Piping
22 14 23	Storm Drainage Piping Specialties
22 42 13	Plumbing Fixtures
22 47 16	Water Coolers

B. The following additional requirements for the **Contract 3c - Plumbing** include, but not limited to, the following:

1. Refer to specification 011200- Special Provisions for additional requirements.
2. The Plumbing contractor shall furnish, install and connect all plumbing supply, sanitary, and storm lines inside the building and to 5' (five feet) beyond the exterior building wall.
3. Removal and proper disposal of all debris.
4. Provide all excavation and backfill for trenches inside building walls associated with their work.
5. Supply access panels/doors to be installed in walls, floors or ceilings to General Contractor for General Construction-Contract 3a to install.
6. Provide starters to Electrical Contractor-Contract 3d, installation to be by Electrical Contractor.
7. Protection of work after installation.
8. Plumbing connection to equipment furnished by any other Contract.
9. Temporary Water: Provide temporary water service as noted in Section 01 50 00 Temporary Facilities and Controls.
10. Install fixtures waste, vent, gas, water and other items for equipment provided by other Contracts.
11. Trades shall identify the locations of required blocking for installation by General Contractor-Contract 3a.
12. Firestopping.
13. Temporarily remove, carefully store and reinstall existing hung ceiling panel assembly as required to access areas of work within plenum.
14. Each contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule.

1.10 CONTRACT 2d – ELECTRICAL

- A. **Contract 3d- Electrical** includes electric power distribution, lighting, data and telecommunication systems. Work under this prime Contract includes, but is not limited to, the following:

DIVISION 00 & 01 GENERAL REQUIREMENTS

DIVISION 02 EXISTING CONDITIONS

- 02 41 19 Selective Demolition (as it pertains to electrical work)
- 02 41 20 Site Demolition (as it pertains to electrical work)

DIVISION 3 – CONCRETE

- 03 05 05 Under Slab Vapor Barrier (as it pertains to electrical work)
- 03 30 00 Cast-in-Place Concrete (as it pertains to electrical work)

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 07 84 43 Firestopping (as it pertains to electrical work)
- 07 92 00 Joint Sealants (as it pertains to electrical work)

DIVISION 8 – OPENINGS

- 08 31 13 Access Doors and Frames (as it pertains to electrical work)

DIVISION 11 – EQUIPMENT

- 11 40 00 Food Service Equipment (as it pertains to electrical work)

DIVISION 14 – CONVEYING EQUIPMENT

- 14 21 00 Electric Traction Elevators (as it pertains to electrical work)

DIVISION 26 – ELECTRICAL

- 26 05 00 Common Work Results for Electrical
- 26 05 19 Low-Voltage Electrical Power Conductors and Cables
- 26 05 23 Control-Voltage Electrical Power Cables 260523-1
- 26 05 26 Grounding and Bonding for Electrical Systems
- 26 05 29 Hangers and Supports for Electrical Systems
- 26 05 32 Interior Raceways Fittings and Accessories
- 26 05 33 Raceway and Boxes for Electrical Systems
- 26 05 34 Electrical Identification
- 26 05 36 Cable Trays for Electrical Systems
- 26 05 43 Underground Ducts and Raceways for Electrical Systems
- 26 05 44 Sleeves and Sleeve Seals for Electrical Raceways and Cabling
- 26 05 48 Seismic Controls for Electrical Systems
- 26 05 53 Electrical Identification
- 26 05 63 Equipment Connections and Coordination
- 26 08 00 Electrical Systems Commissioning
- 26 09 43 Network Lighting Controls
- 26 22 00 Low-Voltage Transformers

26 24 13	Switchboards
26 24 16	Panelboards
26 27 13	Electricity Metering
26 27 26	Wiring Devices
26 28 12	Safety Switches
26 28 13	Fuses
26 28 15	Elevator Power Module Switch
26 28 16	Enclosed Switches and Circuit Breakers
26 51 00	Lighting
26 51 19	LED Interior Lighting
26 56 00	Exterior Lighting

#### DIVISION 27 – COMMUNICATIONS

27 00 00	Communication
27 05 00	Common Work Results for Communications
27 05 26	Grounding and Bonding for Communications
27 05 28	Pathways for Communications Systems
27 05 36	Cable Tray for Communications
27 10 00	Structured Cabling
27 11 00	Communications Equipment Room Fittings
27 13 00	Communications Backbone Cabling
27 15 00	Communications Horizontal Cabling
27 20 00	Data Communications
27 21 00	Data Communications Network Equipment
27 21 02	Data Systems
27 66 00	Communications Equipment Rooms and Fittings

#### DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 00 00	Electronic Safety and Security
28 05 00	Common Work Results for Electronic Safety and Security
28 05 13	Conductors and Cables for Electronic Safety and Security
28 05 28	Pathways for Electronic Safety and Security
28 31 01	Fire Alarm System

- B. The following additional requirements for the **Contract 3d - Electrical** include, but not limited to, the following:

1. Refer to specification 011200- Special Provisions for additional requirements.
2. Removal and proper disposal of all debris.
3. Supply access panels/doors to be installed in walls, floors or ceilings to Contractor for General Construction-Contract 3a to install.
4. Provide all excavation and backfill for trenches inside building walls associated with their work.
5. Install starters supplied by other trades.
6. Protection of work after installation.
7. Electrical connections to equipment supplied by other Contracts.
8. Electrical Contractor will be responsible for all site electrical excavation and backfilling, exclusive of the installation of the new electrical Manhole Structure and Duct Bank.
9. Site lighting and main electric power.
10. Remove and legally dispose of existing PCB containing lighting fixtures, bulbs and ballast.

11. Temporary Electric: Provide Temporary Electrical service and lighting for the project as noted in Section 01 50 00 Temporary Facilities and Controls.
12. Electrical Contract will remove wiring to light fixtures, drop fixtures to floor and dispose of.
13. Trades shall identify the locations of required blocking for installation by General Contractor-Contract 3a.
14. Firestopping and sealing.
15. Temporarily remove, carefully store and reinstall existing hung ceiling panel assembly as required to access areas of work within plenum.
16. Each contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule.

#### 1.11 MISCELLANEOUS

- A. Definition of extent of Prime Contract work: The Contract Documents indicate the extent of each prime contract. Except where the Contract Documents contain a more Specific description, general names and terminology on the Drawings and in the Specification Sections determine which prime contract includes a specific element of the Project.
- B. Local custom and trade union jurisdictional settlements do not control the scope of Work included in each prime contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected prime contracts shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and delays.
- C. If it becomes necessary to refer to the contract documents to determine which prime Contract includes a specific element of required work, begin by referring to the prime Contracts, themselves; then, if a determination cannot be made from the prime Contracts, refer, in the following order, to Specification Section 011200 - Special Provisions, this section of the Specifications, followed by the other Division-1 sections and finally with the Drawings and other Sections of the Specifications.
- D. If, after referring to the contract documents, it cannot be clearly determined which prime Contractor will perform a specific item of required work, then that item of work will be included as a part of the prime Contract for General Construction Work.
- E. Summary of Reference: Work of the prime Contracts can be summarized by reference to the prime contracts, General Conditions, Special Provisions, and Instructions to Modifications to the Contract Document issued subsequent to the initial printing of the Project Manual and referenced by any of these. It is recognized that the work of the prime Contracts is unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions, and other forces outside the contract documents.

#### 1.12 TEMPORARY SERVICE

- A. Temporary service shall be provided as follows:
  1. Temporary power and lighting for building and site by the Electrical Contractor 2d. Electric consumption to be paid by Owner. Temporary electrical service to be available 24hours/day, 7days/week at no additional cost to the owner.
  2. Temporary Heat by the General Construction Contractor 2a - including temporary enclosures at all openings to maintain heat and provide heat for all Trades for temperature sensitive work, activities and material installations and storage, this includes but not limited to cold weather protection for masonry and concrete



construction activities. Assume the building is not closed in; shrink wrap may be required Duration to be from 10/15 to 4/15 for the duration of the project. Refer to Temporary Facilities and Controls 01 50 00 for additional information.

3. Temporary sidewalk sheds/bridges by Contractor for **General Construction-Contract No. 2a.**
4. Temporary sanitary facilities by Contract 2a - General Construction. Quantities per Specification Section 011200 Special Provisions.
5. Temporary water by Contract 2c - Plumbing Contract
6. Snow plowing/shoveling all building areas exposed to weather, inclusive of the Staging Area, temporary parking areas and access to the Owners Trailer/Field Office by Contract 2a - General Construction.
7. Project identification and safety signs by Contract 2a - General Construction.
8. Each Contract is responsible for their temporary offices, storage trailers, electric hook-up and phone service.

#### 1.13 WORK SCHEDULES

- A. All work: done in accordance with a predetermined detailed Work Schedule agreed upon by Owner and Contractors. Each Prime Contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule. Each Prime's Project Schedule are to reflect all requirements for submittals, material and equipment procurement, material stockpiling, setting up Contractor's staging area and surveying of existing conditions. These Schedules, reflecting the critical milestone dates established by the attached 'Bid Schedule', are to be coordinated and shall be inclusive of other Prime Contractor's activity. The "Final" agreed upon overall schedule of work shall be developed and maintained by the Prime Contractor for General Construction in conjunction with the Construction Manager utilizing each Prime Contractor's Preliminary and updated Schedule(s). Specific relationships between Contractors, sequencing of activities, phasing, and critical "ties" of coordinated Work must be detailed on the Project Schedule.
  1. Work Schedule shall be computer generated, in CPM format and in an additional format as approved by the Architect and Owner. Work Schedule shall be revised monthly during the Course of the Work. The latest revised Work Schedule shall be submitted each month with the Application for Payment.
- B. General Contractor shall coordinate work with the Owner, other Contractors at the site, and all of its subcontractors.
- C. Locations of trailers, storage areas, parking areas, and staging areas shall be coordinated with the Owner, Construction Manager and Architect.
- D. It will be the responsibility of the Contractor to carefully interface all construction operations until they reach their final completion, and so the Owner's programs and services can be carried on without interruptions so that a smooth flow of all operations by all involved trades will be achieved within the allotted time.

1.14 ACCESS TO THE SITE

- A. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.15 CODES APPLICABLE

- A. Construction will be governed by: New York State Uniform Fire Prevention and Building Code, current applicable edition, and its referenced codes and standards. State Education Department Manual for Planning Standards.

1.16 PREPARATION OF SITE

- A. Site drawings indicate existing grade elevations, final grade elevations, and locations of work on the property.
- B. Contractor agrees to accept site as indicated and to remove Encumbrances, which interfere with proper fulfillment of his work without change in Contract Sum.
- C. All Work as noted inside or outside of Contract Limit Lines shall be performed by Contractor as part of Contract Work.

1.17 CONTRACTOR'S USE OF PREMISES

- A. Confirm Operations at the Site to Areas and Methods Permitted by:
  - 1. Laws.
  - 2. Ordinances.
  - 3. Permits.
  - 4. Contract Documents.
  - 5. Owner's regulations.
- B. General: It is the Owner's intention to continue occupancy in the existing building, including site and to conduct normal school operations during the time of construction. The Contractor's use of the premises is limited by the Owners use of the building and by the Owners right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
- C. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
- D. Do not unreasonable encumber site with materials or equipment.
- E. Do not load structure(s) with weight that will endanger structure.
- F. Each Subcontractor is responsible for protection and safekeeping of his materials, products and equipment stored on the premises of incorporated into the construction, until his contract is complete and accepted by the Owner.
- G. Site Access: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- H. Move at the Contractor's/Subcontractor's cost any stored materials, products or equipment which interfere with operations of Owner or others.
- I. Special Owner Requirements:
  - 1. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building, prior to Substantial Completion provided that such occupancy does not interfere with completion of Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - 2. All activities required on the site for completion of the work shall be accomplished within the Contract limit lines as indicated on the Drawings.

#### 1.18 LINE AND LEVELS

- A. Drawings indicate location of the Work.
- B. Contractor shall layout all Work prior to construction and will be held responsible for its accuracy. Layout approval by Owner and Architect is required prior to construction.
- C. Owner shall establish a "Datum" or "Bench Mark" at convenient locations, which will remain throughout Work, for convenience and constant reference for use of all Contractors.
- D. Each Contractor is responsible for their own survey(s) and layout.

#### 1.19 TIME FOR COMPLETION

- A. It shall be understood and mutually agreed that the time for Substantial Completion is an essential condition of this Contract.
- B. Contractor agrees that Work shall be prosecuted diligently and uninterruptedly at such rate as will insure Substantial Completion of all Work and Certificates of Occupancy on or before the date stated in the Contract.
- C. Its is expressly understood and agreed by Contractor and Owner that the time for Substantial Completion and Certificates of Occupancy are reasonable, taking into consideration average Climatic range, restrictions concerning use of the site, and Other conditions prevailing.
- D. Contractor shall schedule the Work accordingly.

#### 1.20 EXAMINATION OF SURFACES TO BE COVERED

- A. Prior to application of materials included in the various Sections, the installer, the manufacturer's representative, and the Contractor shall together examine the building and surfaces upon which materials are to be supplied.
- B. The installer and the manufacturer's representative shall accept all surfaces and conditions affecting proper installation of their materials. The installer shall not proceed with the work until all conditions and surfaces not satisfactory to him.
- C. The Contractor shall do all work necessary to correct unsatisfactory conditions and surfaces not specifically included as work of the subcontractor.
- D. The subcontractor shall furnish to the Contractor for submission to the Architect 2 copies of his statement, countersigned by the manufacturer or his appointed representative that the

entire installation has been made by correct techniques over properly prepared surfaces and under proper job conditions.

#### 1.21 FIRE SAFETY REQUIREMENTS

- A. The Contractor shall conform to the following mandatory Requirements during the course of the work:
  - 1. Construction related debris shall be cleaned out of the Building at the end of each working day.
  - 2. No combustible materials shall be stored neither within the building, nor on the school grounds unless as directed.

#### 1.22 COORDINATION DRAWINGS

- A. The Prime Contractor shall coordinate the work of all of their own Sub-Contractors, arrange space conditions to accommodate the work of all trades and prepare composite drawings as required to scale clearly the work of each trade Contractor in relation to each other.
- B. The Contractor will be held responsible to correct unsatisfactory conditions resulting from improper coordination.
- C. Prime Contractors to communicate and supply shop drawings to each other to insure proper coordination.
- D. Coordination drawings shall be submitted to the Architect for review and approval.
- E. Daily field reports are to be provided by all Prime Contractors to the Construction Manager.
- F. Scaled and figured dimensions with respect to the items are approximate only; sizes of equipment have been taken from typical equipment items of the classes indicated. Before proceeding with the work, the contractor shall carefully check all dimensions and sizes and shall assume full responsibility for the fitting in of equipment and materials to the building and to meet architectural and structural conditions.
- G. Separate plans shall also be prepared for sleeve locations and concrete pads for mechanical equipment required by all contractors for the performance of their work. These drawings shall be coordinated with the coordination drawings. When final information is received, such data shall be promptly inserted on the coordination drawings.
- H. The HVAC Contractor shall provide electronic drawing files, at a scale of 3/8" – 1'-0" showing all HVAC equipment, ductwork, and major piping, including elevations and dimensions to all fixed building elements, such as beams; columns, slabs; ceilings; including ceiling suspensions; framing; floor; walls; doors, including door swings; and windows affected by the equipment, ductwork, and piping. Show all registers, grilles, diffusers, radiators and convectors, and other terminal elements. Show location of all valves, dampers (fire, smoke, volume, and automatic), coils, humidifiers, smoke detectors, etc. requiring access for service and maintenance. Locate all access doors. Include large-scale details and sections as required to fully delineate the conditions in congested areas, leaving space for the work of the other contractors. Show plan layout of all equipment bases, pads, and inertia blocks. Clearly label all work by HVAC Contractor.
- I. The Plumbing Contractor shall overlay on the electronic coordination drawings prepared by the HVAC Contractor which indicate all HVAC water supply, drain, waste, vent, sprinkler main and branch piping, risers and sprinkler heads and other major lines. Indicate piping elevations and locations of the fire hose cabinets, drinking fountains, etc., which encroach on duct shafts. Locate valves and other items requiring access for service and maintenance.

Locate all access doors. Avoid interference with HVAC work and with building construction. Use same scale as drawing being overlaid. Clearly label all work by Plumbing Contractor.

- J. The Electrical Contractor shall overlay on the electronic coordination drawings prepared by the HVAC, Plumbing and Fire Protection Contractors all main conduit and bus runs, cable trays, light fixtures, major equipment, and switch gear and panel boards and clearances. Show all items requiring access for service and maintenance. Locate all access doors. Avoid interference with HVAC, Plumbing, and Fire Protection work and with building construction. Use same scale as drawings being overlaid. Clearly label all work by Electrical Contractor.
- K. Each Contractor shall use the signed completed coordination drawings as a working reference. Compare all shop drawings, prior to their submittal to the Construction Manager, with the coordination drawings and revise the shop drawings to fit the coordination drawing condition. If revisions to the coordination drawings are required because of shop drawings, make revisions as directed by Construction Manager and notify all affected contractors with copy of notification to Construction Manager. Maintain up-to-date record of all revisions on own coordination drawing copies; keep one copy at project site.
- L. No extra compensation will be paid to any contractor for relocating any duct, pipe, conduit, or other material installed without coordination among trades involved or among other affected contractors. Each Contractor who causes any additional work to other contractors by improperly coordinated work or work not installed in accordance with the signed coordination drawings shall reimburse the affected other contractors for the cost of the additional work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 010101



## SECTION 011100 – MILESTONE SCHEDULE

### PART 1 – GENERAL

#### 1.01 MASTER SCHEDULE

The following milestone schedule serves as a basis for bidding. A Master Schedule will be developed at a general meeting of the awarded contractor within 10 days of Award the Contracts. This Master Schedule will incorporate the milestones listed below.

#### 1.02 SUBSTANTIAL COMPLETION & MILESTONE DATES

- A. Project Commencement – Date of the Notice to Proceed (NTP) or Date of Contract Approval whichever is earlier.
- B. Milestone Dates – Refer to Milestone Schedule set forth in the Special Provisions Specification Section 011200.

#### D. Final Close-out of all Contract

##### a. Final Close-out of Contract

- i. Final close out of all contracts shall be within 30 days of the substantial completion dates established above. All work including, but not limited to punch lists, project closeout, testing, balancing, owners operation, O&M manuals, as-builts, warranties, etc. shall be complete.
- ii. All work required by the Construction Manager to execute final closeout of contracts after dates noted established above, if determined to be caused by contractor, shall result in payment to the Construction Manager in the form of a change order deduct to the base contract.

#### F. Coordination of Move-In

It is the intent of the School District to begin move-in of furnishings, fixtures and equipment prior to the dates of substantial completion as outlined above. The Contractor shall work in harmony with the School District to facilitate such move-ins for the purpose of beneficial use and occupancy.

#### G. School District/School Operation and Custodial Hours

During the Summer, work will be permitted between **7:00 a.m. and 4:00 p.m.** during the normal work days, Monday through Friday and Saturday as per local ordinances. However, when school is in session, work hours shall be from 3:00 p.m. to 11:00 p.m., Monday through Friday. All after hours work must comply with the allowable working hours and noise ordinance for the **Village of Larchmont**.

Each Prime Contractor may work Saturday & Sundays to make up for lost time (Saturday/Sunday work will be required if necessary to meet deadline) with prior approval from the Owner and after Contractor has verified allowable working hours by town ordinance. Contractors wishing to work on weekends or additional hours during the week shall pay for custodial hours related to same.

Consideration will be given to perform work DURING School Hours provided the area of work has a dedicated access route that does not interfere with the Students & Staff as well as NOT creating any noise in excess of 60dB as mandated by SED guidelines. After Hours work would also be required for any heavy construction work (i.e. piles, steel, etc.) that might pose a potential safety hazard to Students & Staff.

Due to extreme traffic congestion associated with student car and bus transportation, deliveries to any area of the project WILL NOT be allowed during school days from 8:00 a.m. to 9:00 a.m. and 2:00 p.m. to 3:30 p.m.

This Contractor will provide in their base bid five (5) "black out days", to the construction schedule where no work can take place. These dates will be determined by the District and have been incorporated into the milestone dates indicated in the attached bid schedule.

The Contractor shall not interfere with the operation of existing essential services during all normal operating hours and periods. All work requiring temporary interruption of essential services shall be done only with the specific approval of the Construction Manager and Owner. The Contractor shall set up a schedule of work affecting existing services for approval by the Owner and the Construction Manager.

Separate access to the construction activities will have to be provided by the General Contractor, since school will be in session while part of the construction is on-going. The General Contractor will provide temporary stairs, scaffolding, doors, etc. to provide separate access for all trades to the construction areas.

### 1.03 SCHOOL DISTRICT HOLIDAYS

- A. Coordinate with the District for access to work during school holidays as listed below. Hours of work to be from 7:00 a.m. to 4:00 p.m.

Labor Day  
Rosh Hashanah  
Yom Kippur  
Columbus Day  
Veterans' Day  
Thanksgiving  
Winter Recess  
Martin Luther King  
Presidents' Recess  
Spring Recess  
Memorial Day

### 1.04 SCHOOL DISTRICT EVENTS

- A. Coordinate with the District for access to work during days where there are no students present (Superintendent Conference Days, etc.). Hours of work to be determined by the owner for each day.

### 1.05 EXAM / TESTING SCHEDULE

- A. Coordinate with the District for access to work during days when testing will take place at the schools. Hours of work to be from 3:00pm – to 11:00pm (After Hours)

### 1.06 DISTRICT CALENDARS

- A. 2020-2021 Calendar. See following page

END OF SECTION 011100

**MAMARONECK UNION FREE SCHOOL DISTRICT**  
**School Calendar for 2020-2021**

Give Back  
 Conference  
 Closed



SEPTEMBER				
M	T	W	T	F
	1	2	3	4
<del>7</del>	8	9	10	11
14	15	16	17	18
21	22	23	24	25
<del>28</del>	29	30		

OCTOBER				
M	T	W	T	F
			1	2
5	6	7	8	9
<del>12</del>	13	14	15	16
19	20	21	22	23
26	27	28	29	30

NOVEMBER				
M	T	W	T	F
2	3	4	5	6
9	10	<del>11</del>	12	13
16	17	18	19	20
23	24	<del>25</del>	<del>26</del>	<del>27</del>
30				

DECEMBER				
M	T	W	T	F
	1	2	3	4
7	8	9	10	11
14	15	16	17	18
21	22	<del>23</del>	<del>24</del>	<del>25</del>
<del>28</del>	<del>29</del>	<del>30</del>	<del>31</del>	

JANUARY				
M	T	W	T	F
				<del>1</del>
4	5	6	7	8
11	12	13	14	15
<del>18</del>	19	20	21	22
25	26	27	28	29

**SEPTEMBER**

- 3 Superintendent's Conf Day - no students
- 7 Labor Day - No School
- 8 First Day of School: (ALL STUDENTS)  
 Elementary: 8:40AM-3:00 PM (Grades 1-5)  
 8:40 AM - 11:40 AM - kindergarten  
 Hommocks: 8:00 AM - 2:09 PM (Grade 6)  
 9:00 AM - 2:57 PM (Grades 7 & 8)  
 High School: 8:00 AM - 2:42 PM (Grade 9)  
 10:45 AM - 2:42 (Grades 10 - 12)

28 Yom Kippur - no school

**OCTOBER**

12 Columbus Day

**NOVEMBER**

- 3 Superintendent/Conf. Day - no students
- 11 Veterans Day
- 25-27 Thanksgiving Recess

**DECEMBER**

23-31 Holiday Recess

**JANUARY**

- 1 Holiday Recess
- 4 Schools Reopen
- 18 Martin Luther King, Jr.

**FEBRUARY**

15-19 Winter Recess

**MARCH**

- 10 Superintendent/Conf. Day - no students
- 29-31 Holiday Recess

**APRIL**

- 1-2 Holiday Recess
- 5 TBD: Snow/Spring Giveback Day #1

**MAY**

31 Memorial Day

**JUNE**

- 1 TBD: Snow/Spring Giveback Day #2
- 25 Last Day of School

FEBRUARY				
M	T	W	T	F
1	2	3	4	5
<del>8</del>	<del>9</del>	<del>10</del>	<del>11</del>	<del>12</del>
<del>15</del>	<del>16</del>	<del>17</del>	<del>18</del>	<del>19</del>
22	23	24	25	26

MARCH				
M	T	W	T	F
1	2	3	4	5
8	9	10	11	12
15	16	17	18	19
22	23	24	25	26
<del>29</del>	<del>30</del>	<del>31</del>		

APRIL				
M	T	W	T	F
			<del>1</del>	<del>2</del>
<del>5</del>	6	7	8	9
12	13	14	15	16
19	20	21	22	23
26	27	28	29	30

MAY				
M	T	W	T	F
3	4	5	6	7
10	11	12	13	14
17	18	19	20	21
24	25	26	27	28
<del>31</del>				

JUNE				
M	T	W	T	F
	<del>1</del>	2	3	4
7	8	9	10	11
14	15	16	17	18
21	22	23	24	25
28	29	30		



SECTION 011200 – SPECIAL PROVISIONS

**Mamaroneck Union Free School District  
Capital Improvements at Chatsworth Avenue School**



## SPECIAL PROVISIONS

These Special Provisions are in addition to the Plans, Specifications and the other Contract Documents and shall be part of this Agreement between the Owner and the Contractor. All references to "This Prime Contractor", "This Contractor" or "Contractor" refer to the **General Contractor, Plumbing Contractor, Mechanical Contractor** and **Electrical Contractor**. In cases of contradictions, the most stringent Provision shall govern.

### General Requirements for Each Prime Contractor

#### I. General

1. All dates, durations, etc. defined herein shall be in business days.
2. Except for the basic building permit, each Prime Contractor's price shall include all fees and other costs for securing and maintaining (by the Prime Contractors or their subcontractors) for the life of the job; all permits, PE licenses, connection fees, inspections, etc., applicable to, or customarily secured for the Work. This provision includes any applications and/or permits to be issued by utility companies in the name of the Prime Contractor, or the Owner, as required for the Work. Originals of all permits are to be issued in the name of the Prime Contractor as required for the Work. The Prime Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the Work, and, shall prominently display a copy of all permits at a location agreed to with the Construction Manager.
3. One week after Notice to Proceed (NTP), each Prime Contractor shall provide two copies of a video taped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all-existing buildings, grounds, exterior conditions and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Prime Contractor shall be responsible for paying the costs associated with any and all repairs or replacements of existing materials and/ or conditions that were damaged in an area where the Prime Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.
4. Each Prime Contractor is responsible for providing the required mock-ups defined by the Contract Documents out of sequence as needed by the Architect.
5. Each Prime Contractor is responsible for providing all required Engineered material calculations as defined by the contract documents.
6. Each Prime Contractor shall provide drinking water for his own employees.
7. On Site Communications. Each Prime Contractor shall provide, or otherwise see that, the project manager, or site managers, and/or responsible workers of each Prime Contractor and major subcontractor are equipped with cellular phones for the purpose of staying in contact with for the Construction Manager.

8. Each Prime Contractor shall include in his base price the cost of all rigging and equipment required for the performance and installation of the Work.
9. Each bidder who is awarded a contract must perform its work in compliance with all applicable CDC, OSHA and New York State protocols related to the COVID-19 pandemic, including social distancing, cleaning and disinfection protocols. Each bidder who is awarded a contract must ensure the individuals and entities retained by it to perform work comply with all applicable CDC, OSHA and New York State protocols related to the COVID-19 pandemic. Each bidder who is awarded a contract will be responsible to ensure the safety of those retained by the individuals and entities retained by it to perform its contract obligations and will be responsible for the means and the methods utilized to perform the Work. Each bidder who is awarded a contract will be required to cooperate with other contractors engaged by the School District/Owner in providing access to construction areas at the Project site while maintaining compliance with all applicable CDC, OSHA and New York State protocols related to the COVID-19 pandemic.

Any fines imposed or incurred for violation(s) of the Executive Orders of the Governor of New York State related to the COVID-19 pandemic as well as for violation(s) of all applicable CDC, OSHA and New York State protocols related to the COVID-19 pandemic will be the sole responsibility of the bidder awarded a contract whose conduct caused the violation(s).

Each prime contractor must implement and follow all NYS guidelines and regulations regarding COVID-19. Including but not limited to hand washing/sanitizing stations, disinfecting, social distancing, contact tracing logs, etc... COVID-19 protocols, policy and procedures must be detailed and included in each prime contractor's safety manual and logistics plan and is to be submitted to the construction manager. This requirement extends to all subcontractors of the prime contractor.

## **II. Schedule**

1. All Contractors are to recognize that the Project Schedule is of critical importance to the Owner. All aspects of construction must reflect a 'time is of the essence' construction strategy. The attached 'Bid Schedules' serves as a guide of critical milestone dates to the Project. Failure to meet intermediate milestone dates will jeopardize the overall Project Schedule. This failure will mandate Contractor(s) to, increase staff, work overtime, or use other means to recover time, at the costs of those Contractor(s) responsible for such delays. In addition, all costs due to delays in completion of the Work, which require additional Custodial Overtime, Construction Management services, Architectural services, and Engineering services beyond the Work duration in the Bid Schedule, shall be borne by Contractor(s) responsible for delays.
2. Each contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. **Within (3) weeks of NTP all Prime Contractors will provide a coordinated Draft master schedule.** Each Prime's Project Schedule are to reflect all requirements for submittals, material and equipment procurement, material stockpiling, setting up Contractor's staging area and surveying of existing conditions. These Schedules, reflecting the critical milestone dates established by the attached 'Bid Schedule', are to be coordinated and shall be inclusive of other

Prime Contractor's activity. The "Final" agreed upon overall schedule of work shall be developed and maintained by the Prime Contractor for General Construction in conjunction with the Construction Manager utilizing each Prime Contractor's Preliminary and updated Schedule(s). Specific relationships between Contractors, sequencing of activities, phasing, and critical "ties" of coordinated Work must be detailed on the Project Schedule. All Contractors shall utilize "Sure Track Project Manager 3.0-" as produced by Primavera Systems, Inc., -or- equal platform producing Gant Style Scheduling.

3. All Prime Contractors shall review the completed "Final" detailed construction schedule and acknowledge their acceptance of this schedule by signing a copy to be kept on record by the Construction Manager. This agreed upon schedule must incorporate all milestone dates and shall be established within five (5) weeks of Notice to Proceed.
4. The Prime Contractor for General Construction shall update the detailed construction schedule with the Construction Manager and issue copies to the other Prime Contractors, the Owner, Construction Manager, and the Architect monthly. Each Prime Contractor shall provide the Prime Contractor for General Construction with all information necessary to provide these updates.
5. Each Prime Contractor is to submit a schedule of projected fabrication on long lead items (items requiring four weeks and over to fabricate) three weeks after Notice to Proceed. Progress/Status reports on fabrication to be submitted to the Construction Manager every two weeks. 'Rate of Change' chart and marked up shop drawings to be included in these reports.
6. The Prime Contractors shall be responsible for coordinating and expediting their fabrication and delivery schedules and keeping the Construction Manager informed as to their progress and their anticipated ability to stay on schedule. Should it become necessary (in the opinion of the Construction Manager) to supplement the Prime Contractor's expediting efforts in order to maintain job progress, the Construction Manager may elect to charge all costs incurred to said Prime Contractor.
7. In the event that Owner makes special arrangements to open a building at the request of a Contractor and the Contractor does not show, the Prime Contractor shall pay the Owner all costs incurred. All parties agree that any action taken to enforce this requirement shall not be construed by any Prime Contractor or its subcontractors/suppliers, as a reason for a claim (for either time or money) for delay to the Work or to the Prime Contractor, its subcontractors, or suppliers.
8. The Owner shall take partial occupancy of the building additions and renovated spaces in accordance with the dates established by the Bid Schedule and the Special Provisions. The Contractors shall perform all Work necessary to maintain the Owner's move-in and occupancy schedule.
9. The Contractors shall include in their base price, all out of sequence Work and any Work required to be performed during overtime hours or non-working hours necessary to maintain the Master Schedule, the Prime Contractors' project schedule, or, the Owner's move-in schedule.

### **III. Submittal Milestone Requirements**

#### **Submittal Priorities**

The following submittal dates (in business days) are critical to allow for proper fabrication timeframes to ensure timely completion of the project to meet the attached bid schedule. A complete listing of all submittal requirements is located in "Section 01300 Submissions", which shall be accompanied by each division's specific submittal requirements.

#### **Major General Construction Submittals**

Scaffolding and/or Stair tower-(may require PE Stamp)	15 days from Notice to Proceed
Bracing/Shoring-(may require PE Stamp)	15 days from Notice to Proceed
Foundation Shop Drawings	15 days from Notice to Proceed
Rebar/Reinforcing Shop Drawings	15 days from Notice to Proceed
Structural Steel/Decking	15 days from Notice to Proceed
Masonry Submittals/Shop Drawings	15 days from Notice to Proceed
Stormwater/Sanitary	15 days from Notice to Proceed
Doors/Hardware	15 days from Notice to Proceed
Windows/Openings	15 days from Notice to Proceed
Waterproofing	15 days from Notice to Proceed
Vertical Transportation (Elevators)	15 days from Notice to Proceed
Louvers	15 days from Notice to Proceed
Wood Flooring	15 days from Notice to Proceed
Interior Finishes	20 days from Notice to Proceed
Casework	20 days from Notice to Proceed
<b>All remaining Submittals with-in</b>	<b>20 days from Notice to Proceed</b>

#### **Major Site General Construction**

Asphalt Pavement and finish surfaces	15 Days after Notice to Proceed
Concrete curbs and slabs	15 Days after Notice to Proceed
<b>All remaining Submittals with-in</b>	<b>20 days from Notice to Proceed</b>

#### **Major Roofing Construction Submittals**

Roofing/Tapered Shop Drawings	10 days from Notice to Proceed
Roofing	10 days from Notice to Proceed
Mechanical Curbs	10 days from Notice to Proceed
Misc. Structural Steel	15 days from Notice to Proceed
<b>All remaining Submittal with-in</b>	<b>20 days from Notice to Proceed</b>

#### **Major Plumbing Equipment**

Plumbing Equipment	15 days from Notice to Proceed
Plumbing Fixtures	15 days from Notice to Proceed
<b>All remaining Submittals with-in</b>	<b>20 days from Notice to Proceed</b>

**Major HVAC Equipment**

Duct Work	15 days from Notice to Proceed
Equipment	20 days from Notice to Proceed
Controls	20 days from Notice to Proceed
Hot/Chilled Piping and Enclosures	20 days from Notice to Proceed
All remaining Submittals with-in	20 days from Notice to Proceed

**Major Electrical Equipment**

Service Equipment	15 days from Notice to Proceed
Fire Alarm	15 days from Notice to Proceed
Public Address/Intercom	15 days from Notice to Proceed
Light Fixtures	15 days from Notice to Proceed
All remaining Submittal with-in	20 days from Notice to Proceed

**IV. Construction Milestones**

**All Prime Contractors**

Special consideration should be made to the requirements of the project bid schedule attached in the Specifications. Prime Contractors will be required to man each contract to meet the milestone dates indicated below and/or in the contract bid schedule. All costs should be included in the bid for working multiple shifts, nights, weekends and holidays as necessary to complete each phase of the project.

Time frames indicated, show milestone dates required to be met by all Prime Contractors. These areas, once completed, will be punch-listed and given partial occupancy for the Owner to occupy. Occupying these areas is critical to the Owner. If said dates are not met Liquidated damages may be assessed and back-charged to the responsible Contractor.

**KEY MILESTONE DATES:**

**Chatsworth Ave. Elementary School**

**CAFETERIA & KITCHEN RENOVATION**

- Construction Start: **March 1, 2021** | Substantial Completion: **July 31, 2021**
- Sign Off By WCDOH: **July 31, 2021**

**LIBRARY RENOVATION**

- Construction Start: **March 1, 2021** | Substantial Completion: **July 31, 2021**

**NEW ELEVATOR ADDITION**

- Construction Start: **June 29, 2021** | Substantial Completion: **December 31, 2021**

**WOOD FLOORING REPLACEMENTS**

- Construction Start: **June 29, 2021** | Substantial Completion: **August 20, 2021**

**DOMESTIC WATER PIPING REPLACEMENT**

- Construction Start: **June 29, 2021** | Substantial Completion: **August 25, 2021**

#### AUDITORIUM HVAC

- Construction Start: **June 29, 2021** | Substantial Completion: **December 31, 2021**
- *Crane Pick, Dunnage, Duct-work In occupied Academic Spaces by: **August 30<sup>th</sup> 2021***

### **Chatsworth Elementary School**

This building will include a new four stop elevator and classroom addition. The staging for this project will be adjacent to the new elevator addition, on the Chatsworth Avenue side of the building. The new addition will commence construction at the end of June 2021, being substantially complete for the return of the winter/holiday break in December 2021. The main structure will need to be finished prior to the start of school, as crane picks and structural operations over occupied spaces during the normal business hours after August will not be permitted. All structural work or crane picks taking place past the summer recess, will be required to happen after- hours, on holidays or weekends at no additional cost to the Owner. The new addition will also include a new hallway that will be constructed on top of an existing portion of the building. All structural work (Steel, Masonry, Roofing) for the new hallway will need to occur during the summer recess. Light work (non-structural bearing) will be able to commence in the hallway during the academic year, in coordination with the CM and District.

The building will undergo a large classroom floor replacement program which will commence immediately after school dismisses for summer recess, and must be complete before the return of student in September. **The Prime Flooring Contractor performing the work will only be allowed to remove as much wood flooring that can be replaced within a 72-hr period.** Coordination with the CM/Owner is critical to ensure the District prepare these rooms for the new school year.

The Chatsworth Library and Cafeteria will undergo renovations during the spring and summer 2021, taking advantage of an early start for both spaces, which will require work to be after-hours until the start of summer recess. The Cafeteria must be complete and signed-off by the Westchester Department of Health, **no later than July 30, 2021**. Sign off by WCDOH is solely dependent of each trade finishing their work on-time.

### **V. SCHOOL OPERATIONS & CONTRACTOR WORK HOURS**

This project will affect many areas, which in some cases will remain in operation during construction.

All contract work being performed **before and after the summer recess**, during school session, will need to be perform after-hours (3:00pm-11:00pm). The contractor is responsible for abiding by the local sound ordinance for construction activities, and will be responsible for any fines they may incur if not followed.

All contract work occurring **over the summer recess**, outside of school session, may be performed between during the hours of 7:00am and 4:00pm. Any other contract work effecting the operation of the school, at any point over the project schedule, must be performed on an after-hours schedule, weekends or school holidays.



Each Prime Contractor may work Saturday & Sundays to make up for lost time (Saturday/Sunday work will be required if necessary to meet deadline) with prior approval from the Owner and after the Contractor has verified allowable working hours by town ordinance. If any Prime Contractor must work on either a Saturday, Sunday or a Holiday, in order to make up time that has been lost due to the same contractor, that Contractor will be responsible to reimburse the District for any custodial overtime costs.

**Due to extreme traffic congestion associated with student car and bus transportation, deliveries to any area of the project WILL NOT be allowed during school days from**

**Chatsworth: 8:00 a.m. to 9:00 a.m. and 2:30 p.m. to 3:30 p.m.**

**All Contractors will provide in their base bid (5) five “black out days”, per school year, to the construction schedule where no work can take place due to testing or any other discretion of the Owner. These dates will be determined by the District and have been incorporated into the milestone dates indicated in the attached bid schedule.**

## **VI. SAFETY / LOGISTICS/STORAGE**

1. Two weeks after the receipt of the Notice to Proceed, the Prime Contractor for General Construction shall provide a Site Safety/Logistics Plan to the Construction Manager. The site logistics plan should minimally include locations of the eight-foot high temporary fence, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radius, and lift locations. This plan shall also show the location of all staging and storage areas, non-rated and fire-rated partitions used to separate construction and school areas, made with plywood and/or gypsum wallboard, etc. The logistical information represented by the construction documents shall serve as a minimal guide.
2. Each prime contractor is to submit their corporate safety policy (2) weeks after notice to proceed. Plan to minimally meet OSHA standards. Each Prime Contractor shall make the participation of their subcontractors in this program mandatory. These Safety Programs should be a detailed Company Policy defining the specifics as to how a safe work environment shall be maintained
3. Each Prime Contractor and Sub Contractors shall schedule weekly safety meetings (Job Site Safety Talks) and submit meeting minutes indicating attendees and topics to the Construction Manager.
4. Each Prime Contractor is to identify in writing to the Construction Manager their “OSHA Competent Person Regarding Safety” Definition. "Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
5. All flagmen required for deliveries to the site are to be furnished by the Prime Contractor responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner. Delivery blackout periods for bus traffic interference shall be established with the Construction Manager.

6. Smoking, firearms, alcoholic beverages, and indecent photography are expressly prohibited on all school properties. All persons representing Contractors, subcontractors or suppliers shall wear shirts, long pants and other proper attire while on school property. All persons representing Contractors, subcontractors or suppliers shall conduct themselves in a professional manner consistent with the rules and policies of The School District, and the New York State Education Department while on school property or otherwise representing this project.
7. Each Prime Contractor will ensure that all their employees, while on school property, will wear hard hats, high visibility vests, and ID badges at all times. Anyone on site without this safety gear will be escorted off school property.
8. Each Prime Contractor will ensure that every employee working on this project has completed a 10-hour OSHA training course. Any worker that cannot present a 10-hour OASHA safety-training card will be escorted off the property.
9. Food truck vendors for Construction Workers will only be allowed on school property with prior authorization from the School District. The District may allow or discontinue food vendor truck service at any time for any reason.
10. **Identification Badges**. Each Prime Contractor will provide an ID badge for each of their field personnel prior to coming on school property. All workmen shall display the badge on their person while on site, and at all times. Failure to wear identification badge at all times will result in the immediate removal from the jobsite.
11. Each Prime Contractor is responsible for their own storage and personnel trailers at each site. Each Contractor will be required to supply man trailers and storage box trailers as required. All costs related to its delivery, construction, protection, power, etc. is borne by the individual Contractors utilizing space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of these trailers will be strictly limited to predetermined locations. Approval of the placement of any trailer or storage box must be received from the Construction Manager.
12. The parking for construction personnel shall be limited to designated parking areas only. Failure to abide by this rule will result in towing of cars at the expense of the Prime Contractor whom employs the individual.
13. All delivery vehicles/trucks/machinery/etc. permitted on site, must be equipped with back-up alarms and enter through the designated access points. Failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the Prime Contractor responsible for the Work involved.
14. All temporary construction site fences installed by the any Contractor shall be installed with a tightly woven, blind screen mesh. This mesh is to be installed on the "construction" side of the fence. The General Contractor will maintain all fencing daily and lock gates at the end of the day.
15. All crane picks, material delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to ensure the safety of the building occupants. Crane location must be carefully chosen to ensure the safety of building occupants. Crane picks must also not be conducted during academic hours within 20' of a fully-occupied building.

16. The Owner or Construction Manager reserve the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Prime Contractor at its own expense must make corrections before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. Each Prime Contractor or Sub Contractor shall cooperate with the inspector by allowing time for the inspection. The Prime Contractor shall be notified 24 hours prior to the time of the inspection. These inspections do not release the Prime Contractor of their responsibility to provide all engineering, permits, and inspections as required by OSHA or the SED prior to use of any hoisting equipment.
17. All vehicular traffic (personal vehicles, trucks, equipment, deliveries, etc.) are to use the designated entrances as outlined on the Logistics Drawings. Access by other routes is to be on exception basis only.

## **VII. SUBMITTALS**

1. Each copy of each submittal shall have attached as the cover page the "Submittal Cover Sheet". All information requested in "Section 01 33 00 Submittal Requirements" shall be provided by the respective Contractor. Submittals will be returned without review if the cover sheet is not accurately completed.
2. Each Prime Contractor shall generate a complete "Submittal Log" within one calendar week of the Notice to Proceed. This log is to list all required submittals specific to your trade as detailed in the Project Manual/Specs. See enclosed form for your use. "ROJ" stands for Required on Job to assist your judgment of the time gap between submission, Architect review, fabrication/procurement and on-site need for putting the work item into place.
3. Each Prime Contractor shall review all submissions for completeness. Each Prime Contractor is responsible to stamp all shop drawings prior to submission to the Architect. The Architect will not review any shop drawings unless first reviewed by said Contractor. Bundle similar material submissions for proper review. Use the Architects Submittal cover sheet located in the Specifications
4. **All submissions shall be sent electronically to the Architect. Submittals will be processed and stored electronically, with access available to all Prime Contractors for coordination.**
5. Each Prime Contractor shall provide one transmittal for each submission package identifying each unique submission individually. For each submittal with the submission package, the Prime Contractor shall identify the length of the delivery time and the necessary "last date" an item may be received on site. Each Prime Contractor shall keep a log of all submissions in a manner prescribed by the Construction Manager and the attached form. Minimally, the Contractor shall update this submittal log biweekly and provide a copy to the Construction Manager for review and information.
6. Each Prime Contractor shall copy the Construction Manager's Project Manager on all transmittals, correspondence, RFI's and any other documents sent to the Architect, his consultants or the Owner
7. At the direction of the Construction Manager, the Prime Contractor shall provide copies of either document and/or data files for any requested document on one of the following programs: Microsoft Word, Microsoft Excel, or Primavera's SureTrack – Project Manager 2.0 scheduling program.

## **VIII. LINE, LEVELS & GRADE**

1. The Prime Contractor for General Construction shall establish a baseline and benchmark system for each building addition, area of renovation or component. This survey work shall be completed by a NYS licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall not have less than five years' experience in performing construction surveys similar to the work they will perform for this project. The other Prime Contractors and their subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layouts for their own work. Each Prime Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. Each Prime Contractor and their subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by a Prime Contractor or subcontractor, shall be immediately reported to the Construction Manager and Architect. If any corrections are necessary, they shall be executed in accordance with procedures approved by the Construction Manager.
2. Each Prime Contractor and their subcontractors shall be responsible to offset, or to protect, their markings from anything that may disturb them.
3. The Prime General Construction Contractor and all other Contracts will build to existing conditions of the site and joining buildings. To confirm line, level and grade, the Prime General Construction Contractor will employ a licensed NYS surveyor by the end of the project and produce an 'As-Built' drawing including final elevations and boundaries of any structural or earth modifications.

## **IX. MANAGEMENT OF WORK**

1. Each Prime Contractor shall employ (from one week after Notice to Proceed until punch-list and closeout are complete) at a minimum a full-time Project Manager and full-time on-Site Super. The Project Manager and Site Super shall represent the Prime Contractor. All communications given to the Project Manager or Site Super either verbal or written shall be as binding as if given to the Prime Contractor. Important communications shall be so confirmed in writing.
2. Each Prime Contractor shall provide copies of their daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00am the following workday. The daily reports shall provide detailed information concerning the Prime Contractors' activities and operation only. Daily Construction Reports to the owners' representative detailing manpower and work activities on site. A "Daily Construction" form is attached and shall be used for reporting these said activities. In addition, the Contractors are to submit Two Week Look Ahead schedules at every construction meeting which describes coming work in detail. A "Two Week Look a Head" form is also attached and shall be used to report said activities.
3. Each Prime Contractor shall have responsible representation at the **MANDATORY** weekly job meetings held at the Construction Manager's job office from notice to proceed thru close out. These meetings will be held to arrange for a satisfactory coordination of all building trades so as not to impede job progress.

Prime Contractors or subcontractors who fail to attend the meetings will be back-charged \$500.00 per each occurrence.

4. Each Prime Contractor shall submit two-week look ahead schedules identifying the anticipated activity, and material needs for all of the work scheduled to be formed by the Prime Contractor and his subcontractors for the identified time period. The Prime Contractor shall keep this schedule current and provide a biweekly report to the Construction Manager concerning the actual performance and activity compared to the two-week look ahead.
5. The MEP Coordination shall follow the guidelines stated below:
  - a. Each Prime Contractor shall have sufficient responsible representatives at mechanical/electrical/plumbing coordination meetings held at a location to be determined. These meetings shall be held as frequently as required by the Construction Manager or any other Prime Contractor. The General Construction Prime Contractor shall also include a representative at these meetings.
  - b. All Contractors are expected to jointly produce coordination drawings. Prime Contractors are to first submit their respective shop drawings for approval, to the Owner's Architect and Engineers in order to make any necessary changes prior to going through the coordination process. The HVAC Contractor shall provide black line mylars/ CAD Drawings showing all of the approved ductwork. The HVAC Contractor shall locate on these mylars/CAD Drawings all piping in orange pencil/ lines. The Plumbing Contractor shall locate the plumbing lines on these mylars/CAD Drawings in blue pencil/ lines. The Electrical Contractor shall indicate conduit runs in green pencil/ lines. The General Contractor will have the last coordination review. As each coordination drawing is completed, Contractors are to meet with the Construction Manager and the Architect to review and resolve all identified conflicts on the coordination drawings.

Note: for areas without HVAC work, the Mechanical Prime shall provide the necessary mylars/ CAD Drawings with black line. All coordination meetings will be held at the Construction Manager's office.
  - c. It is the responsibility of the Prime Contractor for General Construction to coordinate all points of entry through the foundations, slab penetrations, sleeves, roof openings and penetrations, wall openings and penetrations etc. with the work of all other Contractors, including but not limited to M. E. P. Primes, kitchen equipment, casework and casework accessories.
  - d. It is the responsibility of each Prime Contractor to coordinate with the architectural details and elements, such as soffits, variations in ceiling height and materials, fire/smoke partitions or barriers, folding partition, doors, lockers, and any other general construction items that impact the space above the ceiling or otherwise requiring light framing and/or miscellaneous support or bracing.
6. If any Prime Contractor fails to keep the site safe and clean within four hours of being notified by the Construction Manager either verbally or in writing, the Construction Manager will have this work performed and back charged to the appropriate Prime Contractor at prevailing overtime rates plus 15%. Notice to field personnel is deemed notice to this Prime Contractor.

7. Dust and fume control is essential to the reduction of health risks to the surrounding personnel. Methods of dust control shall include but not be limited to the following:
  - a. Adequate ventilation.
  - b. Wetting down.
  - c. Keeping bags of insulating materials, cement, etc. closed.
  - d. Controlled mixing of materials under field conditions.
  - e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
  - f. Job housekeeping must be maintained.
  - g. Advising all personnel of hazardous conditions, including supervisors and workmen.
  - h. Each Prime Contractor shall be responsible for instituting the above policies to insure minimal impact to surrounding occupied areas.
8. Each Prime Contractor shall confine operations on the premises to areas designated by the Construction Manager and permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the Premises with any materials or equipment. The Prime Contractor shall coordinate all of his operations with, and secure approval from, the Construction Manager, before using any portion of the Premises. Field personnel are to be confined to the work area assigned.
9. Where material is specified to be furnished by others or furnished and delivered only, the Prime Contractor installing the material shall be responsible for scheduling the delivery and receiving, unloading, storing, handling, relocating, hoisting, distribution, laying out and installing this material. Upon receipt by the Prime Contractor installing the material, risk of loss and damage shall be borne by that Contractor.
10. All Prime Contractors and their subcontractors shall allow sufficient time to inspect and accept the work of the previous Contractors. Should any discrepancies be discovered, The Construction Manager shall be notified sufficiently in advance so that corrective action can be agreed to and taken (by all necessary parties) without affecting the progress of any Contractor or the work.
11. All Prime Contractors are advised to exert utmost care and diligence when working in or near any existing buildings or site work which is to remain. The absence of protection around such items shall not excuse the Prime Contractor from his liability to provide protection. Any damages to the existing buildings, sitework or facilities shall be repaired and expensed to the responsible Prime Contractor.
12. Each Prime Contractor shall be solely responsible to remove and replace the existing ceiling tiles and grid in areas of the existing building where their work is required but new ceilings are not scheduled. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible Prime Contractor shall be solely responsible for replacing, in kind, the existing ceilings with new tile and grid. A qualified Contractor, acceptable to the Owner, shall perform all ceiling replacements.
13. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed on an after-hours basis. The performance of this work shall be projected on the required schedules and the Owners Representative is to be notified at least forty-eight



hours in advance of commencing with this work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Prime Contractor performing the work.

14. At the same time the Prime Contractor submits their Insurance Certificate they shall also submit to the Construction Manager the labor rates of each category of labor for which he or his subcontractors shall employ (either directly or indirectly). This information shall be itemized in the format shown below.

Contractor's Name					
Contractor's Address					
Contractor's Office Phone					
Contractor's Fax Number					
Contractor's Email Address					
<b>Labor Rate Breakdown</b>					
Worker's Title		Journey man	1.5 Rate	Fore man	1.5 Rate
Base Hourly Rate					
<b>Payroll Tax &amp; Insurance:</b>	<b>% Per Hr</b>				
FICA					
Federal Unemployment					
State					
Workers Compensation					
Disability					
Other (Explanation Required)					
<b>Subtotal</b>					
<b>Benefits:</b>	<b>\$ Per Hr</b>				
Vacation					
Health & Welfare					
Pension					
Annuity					
401K Fund					
Other (Explanation Required)					
Other (Explanation Required)					
<b>Subtotal</b>					
<b>Hourly Labor Rate</b>					

## **X. REQUEST FOR INFORMATION (RFIs)**

1. Refer to the specifications for a complete explanation of the Request For Information process, and copy of the RFI form. RFIs will be corresponded electronically and will be required for an interpretation needed by the Architect of the Drawings and Specifications.

## **XI. TESTING/INSPECTIONS**

1. If NYSED, the Architect or Owner or determines that any work requires special inspection, testing or approval, the Construction Manager will instruct the Prime Contractor of such special inspection, or testing. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Prime Contractor shall bear all costs thereof, including compensation for the Architect's, Construction Manager, and Testing Lab costs.
2. Contractor shall furnish incidental labor to:
  - a. Provide access to the work to be tested, sampled, and inspected.
  - b. Obtain and handle samples at the project site or at the source of the product to be tested.
  - c. Facilitate inspections, samplings and tests.
  - d. Coordinate with the Owners Rep and testing lab and submit schedule of required tests one week in advance.
  - e. Coordinate inspections
3. As they relate to the timely prosecution of the work, all Prime Contractors shall coordinate independent testing and inspections. If any Prime fails to coordinate such inspections and additional costs are incurred to the Owner, the Prime Contractor will be responsible for that inspection cost.
4. **The following is a list of intended controlled inspections:**
  - a. Soil bearing, sub-grade inspection and/or compaction
  - b. Concrete field and plant testing & rebar placement
  - c. Masonry or stone field inspection, mortar sampling, reinforcement placement inspection
  - d. Structural steel field welding, bolting, connections, and metal deck
  - e. Asphalt and sub-base inspection
  - f. Soil compaction, density and sieve analysis testing, soil bearing
  - g. Water and air infiltration for windows
  - h. Roofing, flashing, waterproofing
  - i. Under slab plumbing work
  - j. Firestopping
  - k. Fireproofing
  - l. Asbestos air monitoring
5. The Architect and Construction Manager shall be notified forty-eight hours prior to the need of testing, in the event the Contractor does not give proper notification and the work is done with no test, that Contractor will bear all costs for such tests.
6. ***All controlled inspection testing costs will be paid for by the Owner except as noted above.***

7. As part of the two-week look ahead, the Prime Contractor shall provide the Construction Manager with a schedule of all anticipated on-site Owner supplied inspections (if any are required). The Prime Contractor shall submit all requests for Owner-supplied inspection for all items of controlled inspection by 1:30 p.m. of the day previous.

## **XII. CHANGES TO THE WORK**

1. Refer to Article 8 of the General Conditions for additional information pertaining to this subject.
2. All change proposals for extra work by the Prime Contractors shall be submitted to the Construction Manager, with a complete labor and material breakdown and on the basis of net difference in quantities. The Owner reserves the right to request adequate back up such as invoices, subcontractor quotes, etc., to substantiate the change order cost. Current labor rates for all trades are to be submitted to the Construction Manager by the respective Prime Contractors at the first scheduled job meeting. When both additions and deductions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of net increase or decrease.

**All change requests shall follow the cost breakdown found in Paragraph 'C' of Article 8 located in the General Conditions.**

## **XIII. SCHEDULE OF VALUES/PAYMENTS**

1. Within one week after Notice to Proceed, the Prime Contractor shall submit a detailed billing breakdown on the AIA G702/ G703 form for approval by Construction Manager. No payments will be made until such billing breakdown is approved.
2. The schedule of values will be reviewed and adjusted if necessary. Once approved, the schedule of values is to be used for the AIA pay application. The schedule of value will take into account and include at minimum the following items:
  - a. Bond/insurance based on actual invoice amount
  - b. Labor and material on line items as applicable
  - c. Submittals - 1% of contract sum
  - d. Punch list - 1% of contract sum
  - e. Close-out documents/warranties - 3% of the contract sum
  - f. Meeting Attendance & Meeting Documentation - 2% of the contract sum
  - g. Allowances
  - h. Approved Alternates
  - i. Labor and Material breakdown for each line item

Note: Punch list value will be dispersed only when the work has been confirmed to be completed 100%.  
ALL PAYMENT APPLICATIONS SHALL INCLUDE A 5% RETAINAGE FACTOR.

3. The Owner has elected to require the Prime Contractor to submit releases of liens with respect to all Work previously performed and for which payments were made under a preceding application. Beginning with the second payment requisition and with each subsequent payment requisition, each Prime Contractor shall furnish to Owner the following documents:
  - a. Labor and/or Materials Affidavit
  - b. Daily and Weekly Wage Affidavit
  - c. Prime Contractor's-Partial Release and Wavier of Lien
4. Monthly Payment Applications for Payments shall be made as per Article 9 of the General Conditions of the Contract
5. All Payment Applications for Payment are to include certified payroll for each employee working directly under the Prime Contractor, as well as all subcontractors working under agreements with the Prime Contractor.

#### **XIV. PUNCH LIST**

1. Upon substantial completion of each phase of work, the Prime Contractors are to submit to the Owner/Construction Manager a letter declaring the work is substantial complete. Included with said letter is to be the Contractor's punchlist. Upon the receipt of above, the Construction Manager will schedule with the Owner, Architect, and Contractor a walk through to develop a single final punchlist. This single final punchlist agreed by all parties shall serve as the only punchlist. Upon failure to complete the final punchlist within two weeks from receipt, the Owner reserves the right to complete same work and backcharge the costs of material, labor, supervision and other incidental costs.

#### **XV. INSURANCE/INDEMNIFICATION**

1. All Prime Contractors must issue a Certificate of Insurance with liability limits as defined in the Construction Documents naming Triton Construction Company, The Architect, The Architect's Consultants and the School District as an 'Additional Insured' in addition to all other parties as stipulated in the General Conditions of the Contract in the project manual.
2. All Prime Contractors agree to indemnify and hold harmless Triton Construction Company, The Architect, The Architect's Consultants, the School District, its agents and employees in addition to all other parties as stipulated in the General Conditions of the Contract in the project manual.
3. All Prime Contractors and Sub-Contractors/sub-subcontractor's/vendors/etc. insurance/indemnification shall comply with Article 11 "Insurance" as specified in the General Conditions of the Contract in the project manual.

## **Specific Scope Requirements for Each Prime Contractor**

***Each Prime Contractor is to refer to the technical specifications and drawings for further, or more comprehensive requirements.***

### **Prime Contractor for General Construction (PCGC)**

1. This Prime Contractor shall provide, for all the building construction work, all necessary site refuse containers and disposal services to maintain the site in a clean and safe condition. This Prime Contractor shall be responsible for emptying and/or replacing all containers on a regular basis or when full. All containers and disposal services shall be provided by a single entity. This Prime Contractor shall provide sufficient labor to keep the site clean on a daily basis and shall be responsible for providing the daily broom cleaning as necessary to maintain site safety.
2. This Prime Contractor shall coordinate with the; Electrician, Plumber and Mechanical Contractors to allow all Contractors unabated access to the building and surrounding work areas.
3. This Prime Contractor shall provide and maintain temporary chemical toilets for the duration of the project at the New Addition and the Renovations. The quantity of these toilets should be as required to properly maintain sanitary facilities and easy access for the personnel on the job. This quantity shall be a minimum of two toilets per major work area. This requirement shall include all necessary paper products, supplies and services, as well as the maintenance of these toilets until all work is complete and the Owner assumes partial occupancy of the building additions and renovations. As a minimum, this Contractor shall include the pumping and servicing of these toilets twice per week.
4. All Scaffolding or stair towers shall be designed and stamped by a licensed NYS PE. When designing this scaffolding consideration should be given to the environment, scaffolding system being used, means of access, means of tying the scaffolding to the structure, location, length of time to be erected, climate conditions, wrapping/containment of building, purpose of use, loadings, etc. all scaffolding and/ or stair tower access points must be secured while not in use. If and when needed, the scaffolding may be used for access by other Prime Contractors during construction- this contractor will not restrict access by others using the scaffold.
5. This Prime Contractor shall provide testing and inspection of the scaffolding on a daily basis and per governing regulation (e.g.,: OSHA). A log of these inspections are to be kept in the PCGC's job trailer, along with inspections tags that identify the status of the scaffolding (inspection dates, okay to use, caution, danger). Report to the Construction Manager all corrective work required through the course of the project.
6. As shown on the logistics plan, this Prime Contractor shall include in his bid price, all costs to provide an **8' ht.** rental type chain link construction fencing and gates. All fencing shall have a tightly woven, blind screen mesh installed on the "construction" side of the fence. Mesh to be dark green or black. When directed by the Construction Manager, this Prime Contractor shall remove and dispose of this fencing and all related materials. Gates for man access shall be passive to the exterior of the jobsite during the event of an emergency, but remain closed for un-authorized entry during construction. All gates shall be locked when the site is not active, with a double-keyed system, granting the District access to the site

after-hours. Included in his bid price, this Prime Contractor shall allow a 1,000lf allowance of orange netting, to be used at the direction of the CM, Architect or Owner.

7. This Prime Contractor shall perform its steel erection according to their Site Logistics/Safety Plan. Booming steel over the Existing Building will not be permitted while occupied. Steel erection within 20 feet of an occupied building/space will require after-hours crane picks.
8. This Prime Contractor will repair, replace, correct, or finish grade, topsoil, and seed all areas with-in the construction site that was disturbed by the work of this project.
9. This Prime Contractor shall provide and maintain all temporary plastic barriers, partition walls, doors, hardware and plywood barriers for the duration of the project to separate work areas from public areas and to maintain security, dust, and noise control. Temporary partitions and doors will be painted with 1x coat of primer and 2x coats of paint for esthetics.
10. Construction Signage. The Prime Contractor shall include in his base price all construction signage required by OSHA. At the site fence, "Construction Area keep out", "Hard Hats Required" and "Authorized personal only" signage shall be posted every 10' on site fencing. This Prime Contractor shall reference the logistics plans for each project to include any other signage designated for entry gates. Signs shall be made of either metal or durable PVC to endure the project duration.

The Prime Contractor shall also include signage for COVID-19 protection, alike the construction signage, stating "Keep Social Distance", "Wear Mask" and "Sanitize Frequently".

11. Professional Cleaning: The PCGC shall provide a professional commercial cleaning service to prepare all areas of interior construction for use and to provide a final cleaning after substantial completion is achieved and after direction to provide such service is received from the Construction Manager. This work shall be completed in cooperation with the building maintenance staff and their respective procedures. As part of this service, the PCGC shall wax all new or repaired floors, and, wash or clean all walls, doors, windows, frames, casework, blinds, unit ventilators, shelves, counters, toilet fixture, sinks, equipment, etc. All work shall be performed in place or on site and does not include sending items out for service or special cleaning operations.
12. Unless specifically noted on the contract documents, this Prime Contractor will provide all concrete equipment pads as shown on the contract documents. All other primes will provide pad sizes and locations.
13. This Prime Contractor is responsible for protection of finished work. Including but not limited to; floors, walls, and doors. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
14. This Prime Contractor should note there are numerous areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's Work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
15. Unless otherwise noted in the construction documents, this Prime Contractor will repair and patch all walls, floors, and ceilings to match adjacent finishes after the removal of interior partitions, ceilings, floors, M.E.P. SP. Conduit, piping and ductwork. This includes all walls and ceilings above finished



ceilings or spaces. Each Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.

16. **Snow Removal:** This Prime Contractor shall provide all equipment, tools and labor for snow removal to assure work can continue through the winter months. Any accumulation of snow in the areas within the construction fencing and directly outside of the fenced-in area, shall be removed immediately by this Prime Contractor. The contractor will work in-hand with the District with their snow removal efforts to ensure access to the site.
17. **Temporary Heat:** As dictated by the bid schedule this Prime Contractor shall provide temporary heat from November thru December for the New Addition. This is to assure that the work of all trades can continue through the winter months. This includes temporary heating equipment, fuel, fire watch, necessary labor/supervision, ventilation, temporary enclosures etc. In no case shall the temperature be less than 50 degrees F. Temporary heating plants using electric power as an energy source can be used with prior authorization by the Architect/CM/Owner.
18. **Building Containment/Wrap: (IF NOT COMPLETE WITH MASONRY AND TEMPERATURE-SENSITIVE MATERIALS, and IF WINDOWS DOORS ARE NOT INSTALLED BY HEATING PERIOD)** This Prime Contractor shall wrap the New Addition. The PCGC must wrap in whole structure between November and December to assure that the interior construction can continue through the winter months. As needed to complete the Building Watertight Milestone, the PCGC shall install temporary enclosures to each building addition opening (windows, doors, louvers, clerestory, storefront, etc.) in order to achieve an environment capable of being temporarily heated should the windows and doors not be installed (Typical temporary WINDOW/DOOR enclosure consist of  $\frac{3}{4}$ " CDW Plywood over 3 5/8" metal stud.
19. This Prime Contractor shall use winter concrete design mix using Pozitec or Accelguard 80 for all concrete work when temperatures reach 40 F or below.
20. This Prime Contractor will be responsible to provide safe egress between floors, which may include the use of temporary stairs w/hand rails; temporary wood treads in metal pan stairs until concrete is poured, ladders, etc. immediately after completion of the structural steel.
21. This Prime Contractor shall provide fire extinguishers for the life of the project, the extinguishers are to be hung and identified as per OSHA requirements (1 per 3000 sq ft, or better). These extinguishers are to be re-charged and inspected for the life of the project.
22. This Prime Contractor shall furnish, install, and maintain an OSHA (3) three line guardrail system (toe board, 2 mid rails and top rails) @ stairwells, open slab edges, MEP shafts, elevator shafts and other openings leading to fall hazards.
23. This Prime Contractor shall furnish, install, and maintain perimeter protection at all floors and roof areas of the new additions. These safety cables must meet all OSHA requirements. The safety cables must be installed with turnbuckles in such a manner as to allow access to the exterior of the building for completion of work by others.
24. If due to location of fabrication plant, a local storage yard is required, all cost associated with this storage yard including receiving, unloading, storing, shake-out, reloading, and delivery to the site shall be this Prime Contractors' cost.
  - a) The Owner may have an Inspector at the plant during the fabrication period. Appropriate access shall be provided at all times for this individual.
25. Prior to each floors lift the Prime Contractor shall provide a survey by a NYS licensed surveyor, with no less than 5 years' experience, indicating wall plumbness and slab elevation prior to final bolting/welding.

26. Shoring/ Support of Excavation: This Prime Contractor will be responsible for hiring a license NYS PE to design a shoring and underpinning plan in effort to build adjacent to existing structures.
27. Stormwater/Underground Drainage: This Prime Contractor will be responsible to install stormwater structures and piping associated with the New Addition work. Stormwater and ponding during the period where final connections have yet to be made will be managed by this Prime Contractor. Ponding of water within or directly outside the site due to construction activities will be mitigated by this Prime contractor by removing the water by pumping or with re-grading the disturbed area.
28. Soil Erosion: This Prime Contractor will be responsible to establish and maintain a soil erosion fence around the disturbed site during the entirety of construction, until authorized by the Civil Engineer/Architect to remove such provisions. This Prime contractor will also provide erosion control at each existing and new nearby storm basin structure. Reference shall be made to the construction plans & documents for additional Soil Erosion provisions required by this Prime Contractor.
29. Abatement Work: This Prime Contractor will be responsible to hire a qualified and DOL licensed Abatement Contractor to perform ALL Hazardous Material removal at areas indicated in the drawings. This work will only take place during the summer recess or over an extended break/holiday such as Spring Break. If the work is unable to be completed by the end of the summer or extended holiday break, abatement will only take place during other holiday weeks, or when students are no occupying the building for extended periods.
30. Under slab MEP Trenching at New & Existing Slabs: This Prime contractor will be responsible to coordinate with the MEP Prime contractors and Construction Manager through the Contract Documents and the Coordination Drawings, for any under-slab piping. This Prime Contractor (PCGC) will be responsible to provide the trenching, bedding, backfill and compaction for such MEP under-slab items. Each MEP Prime Contractor will be responsible to provide a final layout to the PCGC, prior to trenching. Each MEP Prime contractor will be responsible to level their piping with provided bedding from the PCGC, testing the piping prior to back filling.  
  
This Prime contractor will be responsible to survey, sawcut, trench, lay bedding, backfill trench, dowel existing slab and place new concrete to be level to receive new floor finishes. Where slabs are receiving new floors, this Prime Contractor (PCGC) will provide any corrective patching to the top-of-slab and install the new finish floor. Where existing flooring is to remain and be patched; this Prime Contractor will be responsible to match the existing finish, prepare and install new material, at approval of the Architect and CM.
31. Sanitary: This Prime General Construction Contractor will be responsible to install sanitary structures and piping associated with the civil utility work for the New Addition. All tie-ins to existing structures and new structures by this Prime Contractor; includes all required testing. Piping shall be brought to 5' outside the building to be picked up by PCP, continuing into the inside of the building.
32. This Prime Contractor will provide new ductwork penetrations greater than 12"x12" for the PCM, PCE and PCP in walls, ceilings, or floors, as well as any structural support necessary.
33. Each Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.

34. This Prime Contractor will hire the services of an underground utility surveyor to locate and mark all existing underground utilities and services with-in the Area of Work.
35. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect finished product.
36. This Prime Contractor will repair, replace, correct, or finish grade, topsoil, and seed all areas with-in the construction site that was disturbed by the work of this project, including any staging areas for material and equipment.
37. New Mechanical Roof Top Units and Exhaust Fans will be furnished and installed by the Mechanical Contract Prime, with final Electrical/ Fire-Alarm terminations by the Electrical Prime under separate contracts. Roof Top Curbs will be furnished, lifted/picked, and set/installed by the Mechanical Contract Prime. Blocking for curbs, final flashing, roof deck penetrations/openings and structural reinforcing shall be by the PCGC Prime. Coordination between each trade to install the roof system in a seamless matter is required per each Prime's contract. The following sequence clarifies the coordination between the General Construction Prime (PCGC), Mechanical (PCM) and Electrical (PCE) trades for New Mechanical RTU/ Exhausts Fan Equipment:
  - A. Roof Top Unit Curbs:
    1. Furnished, coordinated, lifted/picked and installed (excludes roof flashing) by Mechanical (PCM) Prime
    2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime
    3. Pipe Portals/ Pitch Pockets Furnished by Mechanical (PCM) Prime
    4. Pipe Portals/ Pitch Pockets Installed and Flashed by General Construction (PCGC) Prime
  - B. Rooftop Dunnage
    1. Furnished, coordinated, lifted/picked and installed by General Construction (PCGC) Prime
    2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime
  - C. Mechanical Equipment (RTUs):
    1. Furnished, hoisted/picked and installed by Mechanical (PCM) Prime
    2. Piping by Mechanical (PCM) Prime
    3. Ductwork by Mechanical (PCM) Prime
    4. Controls by Mechanical (PCM) Prime
    5. Electrical by Electrical (PCE) Prime
    6. Fire Alarm/ Shutdowns by Electrical (PCE) Prime

Temporary protection of open curbs prior to units being installed, will be provided and maintained, by the General Construction Contractor in cooperation of all other trades. Water infiltration as a result the Mechanical or Electrical Prime not re-protecting open roof curbs, will be the sole responsibility of that trade to reimburse the PCGC Prime - to correct the temporary protection. Any damages to the interior finishes of the building, caused by water infiltration, will be the responsibility of that Prime Contractor causing the leak, to correct the damages per the terms of the General Conditions.

38. Wood Flooring Replacement: This Prime Contractor will not perform more work than what can be replaced in a 72 hour window. This is in order to protect the School District from the contractor not

being able to finish his work by the end of the summer, and to turn rooms over to the district periodically. Rooms must start being turned over to the District no later than July 25, 2021 and be complete no later than August 20, 2021.

- j) This Prime Contractor will furnish a mockup for the Architect to review prior to commencing with the replacement of any rooms. The mockup will include conditions that include specific details of typical features in each classroom and may be subject rejection.
- k) This Prime Contractor will mitigate dust from entering the hallway from each room. Dust and debris encountered in the hallways, will be the responsibility of this Prime Contractor to clean.
- l) This Prime Contractor will provide a finished floor system per the direction of the Contract Documents. The flooring system will be turned over to the Owner for use without requirement any cleaning or further work. it will be the responsibility of this contractor to provide a dust-cleaning at each room, including but not limited to: shelves, window sills, unit ventilators, radiators, casework and equipment.

### **Prime Contractor for Plumbing (PCP)**

1. The Prime Contractor for General Construction (PCGC) shall provide dumpsters for this trade. Each Prime Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Prime Contractor is responsible to broom clean the areas they worked in at the end of each day.
2. The PCP shall use the dedicated staging areas for the PCP's Construction Field Office. The PCP will be required to remove and reinstall the fencing that surrounds this location for installation of the PCP's construction office. The PCP will be required to install electric, sanitary, water, phone, cable etc. at the PCP's expense. Electric bills to the trailer only will be paid by the Owner.
3. The expediting of *out of sequence hookup* of roof drain piping must be included within this Prime Contractor's base bid to help prevent excessive water from entering into the new/existing building.
4. The Prime Contractor for Plumbing shall include, as part of his base price, all costs associated with providing one hose bib for temporary water service at each major building addition area (if this hose bib does not already exist). The Prime Contractor for Plumbing shall install these hose bibs at locations designated by the Construction Manager.
5. The Prime Contractor for Plumbing should note there are numerous areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's Work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
6. This Prime Contractor shall coordinate with the Electrician, General Contractor, and Mechanical Prime Contractors to allow all Contractors unabated access to the building.
7. Unless otherwise noted in the construction documents, this Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.
8. Each Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.

9. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
10. Trenching under slab (New/Existing): This Prime contractor will be responsible to layout all locations for any under slab piping. The Prime Contractor for General Construction will be responsible to include trenching provisions for under-slab (New or Existing) work where indicated on the plans at new slab locations. This Prime Contractor (PCP) will lay all piping, leveling piping, test and allow the PCGC to backfill in time not to disturb the overall project schedule. This Prime Contractor for General Construction (PCGC) will be responsible to sawcut any existing slabs required to install piping, trench, lay bedding and patch the slab to accept new finishes.
11. Stormwater "Roof Drains and Piping": This Prime General Construction Contractor will be responsible to connect to the stormwater piping 5' outside the building foundation. This contractor will be responsible to core drill, seal and install all piping from 5' outside the building- into the building.
12. Sanitary: This Prime General Construction Contractor will be responsible to connect to the sanitary piping 5' outside the building foundation. This contractor will be responsible to core drill, seal and install all piping from 5' outside the building- into the building.
13. Any openings in excess 12"x12" in walls, or slabs, will be provided by the PCGC prime contractor at the new additions and renovations. This Prime Contractor (PCP) will be responsible for all other small opening, including saw cutting, core-drilling and alike.

#### **Prime Contractor for Mechanical (PCM)**

1. The PCGC shall provide dumpsters for this contractor to use for day-to-day rubbish. Each Prime Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Prime Contractor is responsible to broom clean the areas they worked in at the end of each day. **This Prime Contractor will include in his bid price the provision to remove large HVAC equipment from the site, at his own costs, including but not limited to RTUs, Chillers, Cooling Towers, Unit Ventilators, and Air Handlers.** All other debris is to be disposed of in the PCGC's dumpsters.
2. This Prime Contractor for Mechanical should note there are numerous areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
3. Equipment Pads: Unless specifically noted on the contract documents, the Prime General Construction Contractor will provide all **interior and exterior** concrete equipment pads whether shown on the contract documents or not.
4. This Prime Contractor shall coordinate with the Roofing Contractor, Electrician, Plumber, and General Construction Prime Contractors to allow all Contractors unabated access to the building.
5. Unless otherwise noted in the construction documents, this Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.

6. Each Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.
7. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
8. Both louvers openings, pipe and duct-work openings in excess 12"x12" in walls, or slabs, will be provided by the PCGC prime contractor at the new additions. This Prime Contractor (PCM) will be responsible for all other openings, including saw cutting, core-drilling and alike.
39. New Mechanical Roof Top Units and Exhaust Fans will be furnished and installed by the Mechanical Contract Prime, with final Electrical/ Fire-Alarm terminations by the Electrical Prime under separate contracts. Roof Top Curbs will be furnished, lifted/picked, and set/installed by the Mechanical Contract Prime. Blocking for curbs, final flashing, roof deck penetrations/openings and structural reinforcing shall be by the PCGC Prime. Coordination between each trade to install the roof system in a seamless matter is required per each Prime's contract. The following sequence clarifies the coordination between the General Construction Prime (PCGC), Mechanical (PCM) and Electrical (PCE) trades for New Mechanical RTU/ Exhausts Fan Equipment:
  - A. Roof Top Unit Curbs:
    1. Furnished, coordinated, lifted/picked and installed (excludes roof flashing) by Mechanical (PCM) Prime
    2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime
    3. Pipe Portals/ Pitch Pockets Furnished by Mechanical (PCM) Prime
    4. Pipe Portals/ Pitch Pockets Installed and Flashed by General Construction (PCGC) Prime
  - B. Rooftop Dunnage
    1. Furnished, coordinated, lifted/picked and installed by General Construction (PCGC) Prime
    2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime
  - C. Mechanical Equipment (RTUs):
    1. Furnished, hoisted/picked and installed by Mechanical (PCM) Prime
    2. Piping by Mechanical (PCM) Prime
    3. Ductwork by Mechanical (PCM) Prime
    4. Controls by Mechanical (PCM) Prime
    5. Electrical by Electrical (PCE) Prime
    6. Fire Alarm/ Shutdowns by Electrical (PCE) Prime

Temporary protection of open curbs prior to units being installed, will be provided and maintained, by the General Construction Contractor in cooperation of all other trades. Water infiltration as a result the Mechanical or Electrical Prime not re-protecting open roof curbs, will be the sole responsibility of that trade to reimburse the PCGC Prime - to correct the temporary protection. Any damages to the interior finishes of the building, caused by water infiltration, will be the responsibility of that Prime Contractor causing the leak, to correct the damages per the terms of the General Conditions.

#### **Prime Contractor for Electrical (PCE)**



1. The Prime Contractor for General Construction (PCGC) shall provide dumpsters. Each Prime Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Prime Contractor is responsible to broom clean the areas they worked in at the end of each day.
2. **The Prime Contractor for Electrical is to temporarily support existing ceiling mounted equipment/devices (i.e., speakers, fire alarm apparatuses, exit signs, wiring, light fixtures, etc.) as required for demolition of existing ceilings, in areas being renovated, until new equipment/devices are installed or existing equipment/device can be permanently remounted in the new ceiling.**
3. The Prime Contractor for Electrical shall provide and keep temporary light and power operational for a period of from fifteen minutes before the earliest starting time of the earliest trade, to fifteen minutes after the established quitting time of the trade which stops latest in the evening (fifteen foot candles) throughout the entire building (normal working hours 7:00 am to 4:00 pm). This applies to all scheduled workdays, Monday through Saturday inclusive, which are established as regular workdays for any trade engaged in the work, including such days that are holidays for Electricians but are regular workdays for other trades. These services are to be kept operational until the CM determines that they are no longer required for the execution of the work. Temporary light shall consist of a minimum of (1) bulb and cage per 10 square feet of floor space in all spaces no matter of size throughout the existing building spaces being renovated..
4. The Prime Contractor for Electrical shall include in his base price all costs associated with providing and maintaining adequate temporary light and power to all areas of work required by the construction documents. Each major area of work shall be provided with an adequate sized distribution panel for temporary light and power
5. The Prime Contractor for Electrical shall provide temporary power for masonry work, mixers, steel work, or fire proofing work, compressors etc. that may require 220V temporary power. Power is to be provided at each major area of work if required.
6. The Prime Contractor for Electrical should note there are numerous areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
7. The Prime Contractor for Electrical shall replace all burned out light bulbs, within the work areas, when building is turned over to the owner at substantial completion.
8. This Prime Contractor shall coordinate with the, Roofing Contractor, General Contractor, Plumber, and Mechanical Prime Contractors to allow all Contractors unabated access to the building.
9. Unless otherwise noted in the construction documents, this Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.
10. Each Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.

11. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
12. This Prime Contractor will modify all existing Fire Alarm devices that are part of the existing building being renovated, maintain the devices throughout construction, and or disconnect as needed. This Prime Contractor will assure that no troubles exist, by hiring a Fire Alarm vendor who is licensed to modify the existing Fire Alarm system to accept any temporary changes through construction. If any work compromised the Fire Alarm system during academic hours, then modification shall happen after hours.
13. This Prime Contractor is to develop a separate site-specific electrical service shutdown/upgrade schedule within four weeks after Notice to Proceed. This schedule will be developed in conjunction with the Construction Manager and the Owner. No shutdown/transfer will be permitted at any time without prior written notification. The Prime Contractor for Electrical shall provide temporary power for all 'others' work ongoing at the site during any electrical shutdown or transfer period that would otherwise deny other Contractors power. No shutdown or transfer shall be allowed during active school hours. Any and all shutdowns must be scheduled on the Owners off days (weekends, holidays). Any shutdown longer than three days will require this Prime Contractor to supply temporary power for the Owner (i.e., generators). The Electrical Prime Contractor shall provide a minimum of forty-eight hours' notice to the Owner and the Construction Manager or any necessary power shutdown.
9. Trenching under slab (New/Existing): This Prime contractor will be responsible to layout all locations for any under slab piping. The Prime Contractor for General Construction will be responsible to include trenching provisions for under-slab (New or Existing) work where indicated on the plans at new slab locations. This Prime Contractor (PCE) will lay all piping, leveling piping and allow the PCGC to backfill in time not to disturb the overall project schedule. This Prime Contractor for General Construction (PCGC) will be responsible to sawcut any existing slabs required to install piping, trench, lay bedding and patch the slab to accept new finishes.
10. Any openings in excess 12"x12" in walls, or slabs, will be provided by the PCGC prime contractor at the new additions and renovations. This Prime Contractor (PCE) will be responsible for all other small opening, including saw cutting, core-drilling and alike.
40. New Mechanical Roof Top Units and Exhaust Fans will be furnished and installed by the Mechanical Contract Prime, with final Electrical/ Fire-Alarm terminations by the Electrical Prime under separate contracts. Roof Top Curbs will be furnished, lifted/picked, and set/installed by the Mechanical Contract Prime. Blocking for curbs, final flashing, roof deck penetrations/openings and structural reinforcing shall be by the PCGC Prime. Coordination between each trade to install the roof system in a seamless matter is required per each Prime's contract. The following sequence clarifies the coordination between the General Construction Prime (PCGC), Mechanical (PCM) and Electrical (PCE) trades for New Mechanical RTU/ Exhausts Fan Equipment:
  - A. Roof Top Unit Curbs:
    1. Furnished, coordinated, lifted/picked and installed (excludes roof flashing) by Mechanical (PCM) Prime
    2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime

3. Pipe Portals/ Pitch Pockets Furnished by Mechanical (PCM) Prime
4. Pipe Portals/ Pitch Pockets Installed and Flashed by General Construction (PCGC) Prime
- B. Rooftop Dunnage
  1. Furnished, coordinated, lifted/picked and installed by General Construction (PCGC) Prime
  2. Deck/Roof Opening, Structural Reinforcing, Blocking, Insulation and Roof Flashing by General Construction (PCGC) Prime
- C. Mechanical Equipment (RTUs):
  1. Furnished, hoisted/picked and installed by Mechanical (PCM) Prime
  2. Piping by Mechanical (PCM) Prime
  3. Ductwork by Mechanical (PCM) Prime
  4. Controls by Mechanical (PCM) Prime
  5. Electrical by Electrical (PCE) Prime
  6. Fire Alarm/ Shutdowns by Electrical (PCE) Prime

Temporary protection of open curbs prior to units being installed, will be provided and maintained, by the General Construction Contractor in cooperation of all other trades. Water infiltration as a result the Mechanical or Electrical Prime not re-protecting open roof curbs, will be the sole responsibility of that trade to reimburse the PCGC Prime - to correct the temporary protection. Any damages to the interior finishes of the building, caused by water infiltration, will be the responsibility of that Prime Contractor causing the leak, to correct the damages per the terms of the General Conditions.

14. This Prime Contractor for Electric shall include in their proposal procurement of a certified Sound System Contractor to provide and install the sound system as per the contract documents. The PCE shall ensure a complete turn-key system.
15. This Prime Contractor for Electric shall provide and install all labor, materials, and fixtures necessary for a fully functional PA system that is tied into the existing school PA system.

## SECTION 012200 – UNIT PRICES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing work associated with unit prices. Related documents include drawings and other general provisions of the Contract, including General Conditions and other Division 1 specification sections.

#### 1.02 RELATED SECTIONS

- A. Section 01 26 00 - "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
- B. Section 01 33 00 – "Submittal Procedures"

#### 1.03 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

#### 1.04 PURPOSE

- A. Unit prices stated on the Bid Form shall be used as a basis of compensation for increases, or decreases, in specified items of Work by Change Order in accordance with the General Conditions.

#### 1.05 PROCEDURES

- A. Include in unit prices all necessary material, plus cost of delivery, installation, insurance, overhead and profit.
- B. When requested by the Architect/Engineer, submit data identified in the General Conditions supporting the unit price costs.
- C. The Owner reserves the right to reject the Contractor's measurement of work in place that involves the use of established unit prices and to have work measured at the Owner's expense by an independent surveyor.
- D. List of Unit Prices: A list of unit prices is included in Part 3 of this specification.

### PART 2 PRODUCTS

NOT USED

## PART 3 EXECUTION

### 3.01 LIST OF UNIT PRICES – **CONTRACT 3a (General Construction)**

- A. Contract 3a (GC): Unit Price #3a-1 – Asbestos – Large Project Decon:  
Bidder to provide a unit price for the installation, use and removal of one (1) Large Project Decontamination work area to remove additional piping insulation and MJP's. Refer to Specification Section 028200. Unit price to be per enclosure and shall include all required prep work.
- B. Contract 3a (GC): Unit Price #3a-2 – Asbestos – Small Project Decon:  
Bidder to provide a unit price for the installation, use and removal of one (1) Small Project Decontamination work area to remove additional piping insulation and MJP's. Refer to Specification Section 028200. Unit price to be per enclosure and shall include all required prep work.
- C. Contract 3a (GC): Unit Price #3a-3 – Asbestos – OSHA Wash Station for Minor Project:  
Bidder to provide a unit price for the installation, use and removal of one (1) OSHA Wash Station for Minor Project, Abatement up to nine (9) MJP's and less than 10SF of Floor Tile & Mastic. Refer to Specification Section 028200. Unit price to be per wash station and shall include all required prep work.
- D. Contract 3a (GC): Unit Price #3a-4 – Site/Civil Rock Removal  
In their base bid, the Bidder shall assume the project requires 150 cubic yards of rock removal. Bidder to provide a unit price for rock removal per cubic yard if the quantity is over or under 150 cubic yards. Unit price shall include all required prep work. Rock removal is by hammer only, blasting will not be allowed. Refer to Specification Section 31 20 00.

END OF SECTION 012200

## SECTION 012300 – ALTERNATES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

#### 1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.04 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.01 SCHEDULE OF ALTERNATES – **CONTRACT 3a (General Construction)**

- A. Contract #3a (GC): Add Alternate No. 3a-1: Floor Replacement – Nurse's Office

Contractor to provide a price to replace the flooring in the Nurse's Office per Drawing A1.40 and A2.40.



B. Contract #3a (GC): Add Alternate No. 3a-2: Sky Gym Renovations (Work Area "D")

Contractor to provide a price to perform all renovation work in the Sky Gym (Work Area "D") as per Drawing A7.30. Work associated with the new door from the addition is base bid.

END OF SECTION 012300

## SECTION 012500 – SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Article 6(X) of the General Conditions for requirements concerning substitutions.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements: Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
  - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 PROCEDURES

- A. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall indicate the desired substitution in its bid, including the following:
  - 1. For which specified material or equipment the request for substitution is being made;
  - 2. What kind, type, brand, or manufacturer is sought to be substituted for the specified items;

3. Written documentation evidencing that the substituted material or equipment meets or exceeds the specifications for materials and/or equipment set forth in the project manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, significant quantities of proposed substitution (e.g. performance, weight, size, durability and visual effects), and other like information necessary for the complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with the requirements indicated. All such data shall be provided to the Architect and Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the projects in the event that the substitution is acceptable. Additionally, the Contractor shall submit to the Architect information describing in specific detail how the proposed substituted product differs from the quality and performance required by the base specifications, and such other information as may be required by the Owner and the Architect.
4. Coordination information, including a list of changes or modifications needed to other parts of the Work and the construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
5. Samples, where applicable or requested.
6. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
7. Detailed comparison of the difference in cost between the specified product and the proposed substitution including any and all costs associated with changes or modifications needed to other parts of the work and to construction performed by the Owner and/or separate Contractors that will be necessary to accommodate proposed substitution. In the event the substitution is acceptable, the Contractor proposing the use of the substitution shall bear all costs associated with said changes or modifications.
8. By making said requirements in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:
  - a. Represents that the representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified.
  - b. Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product.
  - c. Certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the architect and engineers to implement said substitutions and waives any and all claims for additional costs related to the substitution which subsequently became apparent.
  - d. Represents that it will coordinate the installation of the accepted substitute, making all such changes to the drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and

ventilation specifications as may be required for the work to be complete in all respects.

- e. An affidavit stating that (1) the proposed substitution conforms and meets all requirements shown on the Drawings and (2) the Contractor accepts the warranty and correction obligations in connection with this proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the construction schedule.

9. Proposals for substitutions shall be submitted with the Contractor's Bid.

10. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

## 1.5 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified product or fabrication, or installation cannot be provided, if applicable.
- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution

request, is compatible with related materials, and is appropriate for applications indicated.

- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 10 days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
- b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## 1.6 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.7 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

# PART 2 - PRODUCTS

## 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than **15** days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- b. Substitution request is fully documented and properly submitted.
- c. Requested substitution will not adversely affect Contractor's construction schedule.
- d. Requested substitution has received necessary approvals of authorities having jurisdiction.
- e. Requested substitution is compatible with other portions of the Work.
- f. Requested substitution has been coordinated with other portions of the Work.
- g. Requested substitution provides specified warranty.

- h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise submitted per Article 6(X) of the General Conditions

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500





## SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Article 8 of the General Conditions concerning Changes in Work.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

#### 1.3 CHANGES IN THE WORK

- A. Without invalidating the agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions, or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.
- B. Change in work shall follow the requirements of Article 8 of the General Conditions. If there are any procedural discrepancies between the procedures listed below and those of the General Conditions, the General Conditions shall take priority.

#### 1.4 MINOR CHANGES IN THE WORK

- A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions." or form included in Project Manual.

#### 1.5 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect and/or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect and/or Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost

adjustments to the Contract Sum and the Contract Time necessary to execute the change.

- a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
- b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- c. Include costs of labor and supervision directly attributable to the change.
- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- e. Quotation Form: Use forms acceptable to Architect or Construction Manager.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a proposal by submitting a request for a change to Construction Manager.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect or Construction Manager.

## 1.6 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

## 1.7 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner, Contractor, and Construction Manager on AIA Document G701.

## 1.8 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect and/or Construction Manager may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600



## SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes administrative procedures for Project Coordination by the Architect and Construction Manager and the responsibilities of all Prime Contractors to contribute and cooperate with the coordination of the construction operations on the Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor and all shall be overseen by the Architect and Construction Manager.
- C. Related Sections include the following:
  - 1. Division 1 Section "Submittal Procedures" for Administrative and Procedural Requirements for submitting Shop Drawings.
  - 2. Division 1 Section "Close-out Procedures" for coordinating Contract closeout.

#### 1.03 COORDINATION

- A. Project Coordination: Architect/Construction Manager shall coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Construction operations included in different Sections that depend on each other for proper installation, connection, and operation shall be coordinated between trades under the supervision of the Architect/Construction Manager.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.



2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
  4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- C. Architect and Construction Manager shall prepare memoranda for distribution to each party involved, outlining special procedures required for coordination.
- D. Administrative Procedures: All Prime Contractors shall work with the Architect and Construction manager to coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Startup and adjustment of systems.
  8. Project closeout activities.
- E. Conservation: All Prime Contractors shall work with the Architect and Construction manager to coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.04 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

- a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
  - b. Indicate required installation sequences.
  - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- 2. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within fourteen (14) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
  - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

#### 1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
  - 1. Include special personnel required for coordination of operations with other contractors.

#### 1.06 PROJECT MEETINGS

- A. General: Architect and Construction Manager shall schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  - 1. Attendees: Architect and Construction Manager shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
  - 2. Agenda: Architect and Construction Manager shall prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Architect and Construction Manager shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned of including Owner and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference: Architect and Construction Manager shall schedule a preconstruction conference before starting construction, at a time convenient to Prime Contractors, Owner, Construction Manager and Architect, but no later than seven (7) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for requests for interpretations (RFIs).
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Use of the premises.
    - l. Work restrictions.
    - m. Owner's occupancy requirements.
    - n. Responsibility for temporary facilities and controls.
    - o. Construction waste management and recycling.
    - p. Parking availability.
    - q. Office, work, and storage areas.
    - r. Equipment deliveries and priorities.
    - s. First aid.
    - t. Security.
    - u. Progress cleaning.
    - v. Working hours.
  3. Minutes: Construction Manager will record and distribute meeting minutes.
- C. Preinstallation Conferences: Architect and Construction Manager shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related requests for interpretations (RFIs).
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.

- i. Possible conflicts.
  - j. Compatibility problems.
  - k. Time schedules.
  - l. Manufacturer's written recommendations.
  - m. Warranty requirements.
  - n. Temporary facilities and controls.
  - o. Space and access limitations.
  - p. Regulations of authorities having jurisdiction.
  - q. Testing and inspecting requirements.
  - r. Installation procedures.
  - s. Coordination with other work.
  - t. Required performance results.
  - u. Protection of adjacent work.
  - v. Protection of construction and personnel.
- 3. Architect and Construction Manager shall record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- 4. Reporting: Architect and Construction Manager shall distribute minutes of the meeting to each party present and to parties who should have been present.
- 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Architect and Construction Manager shall conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.
  - 1. Attendees: In addition to representatives of Construction Manager, and Architect, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.

- 3) Status of submittals.
  - 4) Deliveries.
  - 5) Off-site fabrication.
  - 6) Access.
  - 7) Site utilization.
  - 8) Temporary facilities and controls.
  - 9) Work hours.
  - 10) Hazards and risks.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Requests for interpretations (RFIs).
  - 16) Status of proposal requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
3. Minutes: Architect and Construction Manager will record and distribute to Contractor the meeting minutes.
  4. Reporting: Architect and Construction Manager shall distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Architect and Construction Manager shall revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Construction schedule updating reports.
  - 3. Daily construction reports.
  - 4. Site condition reports.

#### 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file, where indicated.
  - 2. PDF electronic file.
  - 3. [2] paper copies.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.



1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  3. Total Float Report: List of all activities sorted in ascending order of total float.
  4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Issue schedule one week before each regularly scheduled progress meeting.
- F. Daily Construction Reports: Submit to Construction Manager daily.
- G. Site Condition Reports: Submit immediately on discovery of a difference between site conditions and the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  5. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and Contract Time.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 30 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.

- i. Testing and commissioning.
  - j. Punch list and final completion.
  - k. Activities occurring following final completion.
- 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
- 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
- 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
  - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
  - 1. Contractor or subcontractor and the Work or activity.
  - 2. Description of activity.
  - 3. Main events of activity.
  - 4. Immediately preceding and succeeding activities.
  - 5. Early and late start dates.
  - 6. Early and late finish dates.
  - 7. Activity duration in workdays.
  - 8. Total float or slack time.
  - 9. Average size of workforce.
  - 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
  - 1. Identification of activities that have changed.
  - 2. Changes in early and late start dates.
  - 3. Changes in early and late finish dates.
  - 4. Changes in activity durations in workdays.
  - 5. Changes in the critical path.

6. Changes in total float or slack time.
7. Changes in the Contract Time.

## 2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events.
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Work Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200





## SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
- B. Related Sections include the following:
  - 1. Division 1 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.

#### 1.03 SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.
- B. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.
  - 1. Identification: Label each photo with:
    - a. Date photograph was taken if not date stamped by camera.
    - b. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    - c. Unique sequential identifier.
  - 2. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints as a Project Record Document on a USB flash drive. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

#### 1.04 COORDINATION

- A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

## 1.05 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

## PART 2 - PRODUCTS

### 2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

## PART 3 - EXECUTION

### 3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in filename for each image.
  - 2. Field Office Images: Maintain one set of images on USB CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.
- C. Preconstruction Photographs: Before commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
  - 1. Take eight photographs to show existing conditions adjacent to property before starting the Work.
  - 2. Take twenty photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take 12 color, digital photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of color, digital photographs and general

directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

- F. Final Completion Construction Photographs: Take eight color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

- 1. Do not include date stamp.

END OF SECTION 013233



## SECTION 013300 – SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Refer to Section 011200 "Special Provisions" for additional procedures regarding submittals.
- C. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for submitting substitutions.
  - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 014339 "Mockup Requirements" for preparation and submission of mockups.  
Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

#### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

#### 1.3 ACTION SUBMITTALS

- A. Each Prime Contractor shall generate a complete "Submittal Log" within one calendar week of the Notice to Proceed. This log is to list all required submittals specific to your trade as detailed in the Project Manual/Specs. See enclosed form for your use. "ROJ" stands for Required on Job to assist your judgment of the time gap between submission, Architect review, fabrication/procurement and on-site need for putting the work item into place.

#### 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
  - 1. Upon request, the Architect will furnish Contractor digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.



- b. Contractor shall execute a data licensing agreement in the form of Architects CAD Release form.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow [7] seven days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  - 3. Resubmittal Review: Allow [7] seven days for review of each resubmittal.
- D. Options: Identify options requiring selection by Architect.
- E. Deviations: Identify deviations from the Contract Documents on submittals.
- F. Resubmittals: Make resubmittals in same form as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 ELECTRONIC SUBMITTAL PROCEDURES

#### A. Summary:

- 1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format. Submissions will be either via email or a data sharing website. The Submit-

tal Exchange website service designed specifically for transmitting submittals between construction team members may also be used for this project ([www.submittalexchange.com](http://www.submittalexchange.com)). If so, the costs for this service will be paid for by the School District and log in credentials will be assigned to the Prime Contractors.

2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures:

1. Submittal Preparation - Contractor may use any or all of the following options:
  - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
  - b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
  - c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
4. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
5. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Section 017700 – Close-out Procedures

C. Training:

1. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 515-393-2261.
2. Internet Service and Equipment Requirements:
  - a. Email address and Internet access at Contractor's main office.
  - b. Adobe Acrobat ([www.adobe.com](http://www.adobe.com)), Bluebeam PDF Revu ([www.bluebeam.com](http://www.bluebeam.com)), or other similar PDF review software for applying electronic stamps and comments.

## 2.2 GENERAL SUBMITTAL PROCEDURES

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
  - a. Manufacturer's catalog cuts.
  - b. Manufacturer's product specifications.
  - c. Standard color charts.
  - d. Statement of compliance with specified referenced standards.
  - e. Testing by recognized testing agency.
  - f. Application of testing agency labels and seals.
  - g. Notation of coordination requirements.
  - h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
  - a. Wiring diagrams showing factory-installed wiring.
  - b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
  - a. PDF electronic file.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit [2] two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit [3] three sets of Samples. Architect will retain [2] two Sample sets; remainder will be returned.
    - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least [3] three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Submit product schedule in the following format:
    - a. PDF electronic file.
- E. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Close-out Procedures."
- I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- S. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and [3] three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Close-out Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action as follows:
  1. "NO EXCEPTIONS TAKEN": Submission is in full compliance with all contract documents, or indicated deviations are acceptable.
  2. "MAKE CORRECTIONS NOTED": Submission has minor corrections not significant enough to require resubmission; noted corrections must be made in final installation.
  3. "REJECTED": Submission does not meet contract requirements; resubmission of shop drawings, which meet contract requirements, is required.
  4. "AMEND AND RESUBMIT": Resubmission is required due to the nature and/or number and corrections.
- C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.



- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

## SECTION 014000 – QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Contractor is responsible for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner/Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 2. Technical Sections for specific test and inspection requirements.

#### 1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect in writing for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision in writing before proceeding.

#### 1.05 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.
  - 4. Identification of test and inspection methods.
  - 5. Number of tests and inspections required.
  - 6. Time schedule or time span for tests and inspections.
  - 7. Entity responsible for performing tests and inspections.
  - 8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.06 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

#### 1.07 QUALITY CONTROL

- A. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 2. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. **Testing Agency Responsibilities:** Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- E. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within sixty (60) days of date established for the Notice to Proceed.



1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 014339 – MOCKUP REQUIREMENTS

### PART 1 GENERAL

#### 1.01 GENERAL

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the General Conditions of the Contract and the balance of Division #1 and specifications.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the General Conditions of the Contract and the balance of Division #1 and specifications.
- B. Specification Sections that Require a Mockup:
  - 1. 040120 – Unit Masonry Restoration
  - 2. 040122 – Stone Restoration
  - 3. 042113 – Brick Masonry
  - 4. 047200 – Cast Stone Masonry
  - 5. 062000 – Finish Carpentry
  - 6. 066116 – Solid Surface Fabrications
  - 7. 093019 – Porcelain Tile

#### 1.03 SUBMITTALS

- A. Quality Control Submittals
  - 1. Mockup Plan: Copy of proposed plan.

#### 1.04 DEFINITIONS

- A. Mockups (General): Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances.
  - 1. Mockups are not Samples.
  - 2. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- B. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- C. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

#### 1.05 QUALITY ASSURANCE

- A. Mockup Plan: Detailed, dimensioned plans and elevations showing mockup size, and items and materials that will be included in proposed mockup.
- B. Pre-Construction Conference: Prior to the construction of the mockup, a conference will be called by the Director's Representative at the Site for the purpose of reviewing the requirements, and intent of mockup. The conference shall be attended by the Director's Representative, Contractor, and person supervising this phase of the Work

#### PART 2 PRODUCTS (Not Used)

#### PART 3 EXECUTION

##### 3.01 INSTALLATION

- A. Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish as directed.
  - 1. Build mockups in location and of size and profile indicated or, or as directed by the Owner's Representative (Construction Manager and/or Architect).
  - 2. Notify the Owner's Representative a minimum of 5 days in advance of dates and times when mockups will be constructed and able to be inspected.
  - 3. Employ supervisory personnel to oversee mockup construction. Employ same workers that will be employed during the construction of Project.
  - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 5. Commence the Work after mockup has been inspected and approved in writing by Director's Representative.
  - 6. The mockup will establish the standard of quality of workmanship by which the Work will be judged.
  - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work. Failure to maintain the mockup, until directed, will be cause for rejection of the Work.
  - 8. Demolish and remove mockups when directed unless otherwise indicated.
- B. Mockup Types: Construct mockup in accordance with approved shop drawings, project manual, and Contract Drawings, using exact materials and methods approved for the Project, including required accessories.

1. Integrated Exterior Mockups: Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections and supporting materials.
2. Room Mockups: Construct mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable the Owner's Representative to evaluate quality of the Work.

END OF SECTION 014339



## SECTION 014533 – CODE-REQUIRED SPECIAL INSPECTIONS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Submittals.

#### 1.02 RELATED REQUIREMENTS

- A. Section 013300 - Submittal procedures.
- B. Section 014000 - Quality Requirements.
- C. Section 016000 - Product Requirements: Requirements for material and product quality.

#### 1.03 DEFINITIONS

- A. Code or Building Code: ICC (IBC), 2015 Edition of the International Building Code with New York state supplements and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. National Institute of Standards and Technology (NIST).
- D. Special Inspection:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

#### 1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. AISC 360 - Specification for Structural Steel Buildings; 2010.
- C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.
- D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in



the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

- F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- G. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).
- H. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).
- I. ASTM E2570 - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007.
- J. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 1998.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- L. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- M. ICC (IBC) - International Building Code; 2015.

#### 1.05 SUBMITTALS

- A. See Section 013300 - Submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
  - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Smoke Control Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
  - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  - 2. Submit documentary evidence that agency has appropriate credentials and documented experience in fire protection engineering, mechanical engineering and HVAC air balancing.
  - 3. Submit certification that Testing Agency is acceptable to AHJ.
- D. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
  - 1. Include:

- a. Date issued.
- b. Project title and number.
- c. Name of Special Inspector.
- d. Date and time of special inspection.
- e. Identification of product and specifications section.
- f. Location in the Project.
- g. Type of special inspection.
- h. Date of special inspection.
- i. Results of special inspection.
- j. Conformance with Contract Documents.

#### 1.06 SPECIAL INSPECTION AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION

##### 3.1 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
  - 1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- B. Special inspections required by Section 1705 may not be required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents

##### 3.2 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Special inspection for structural steel shall be in accordance with the quality assurance inspection requirements of AISC 360
- B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.

1. Snug tight joints; periodic.
- C. Welding:
1. Structural steel and cold formed steel deck:
    - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
    - b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
    - c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
    - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
    - e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
  2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
    - a. Verification of weldability; periodic.
    - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
    - c. Shear reinforcement; continuous.
    - d. Other reinforcing steel; periodic.
- D. Steel Frame Joint Details: Verify compliance with approved contract documents.
1. Details, bracing and stiffening; periodic.
  2. Member locations; periodic.
  3. Application of joint details at each connection; periodic.
- E. Cold formed steel trusses spanning 60 feet or more; periodic.

### 3.3 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
- C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
- D. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Sections 5.6 and 5.8 and record the following, continuous:
  1. Slump.
  2. Air content.
  3. Temperature of concrete.

- E. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.
- F. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, Section 6.2, for the following.
- G. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, Section 6.1.1; periodic.

### 3.4 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
  - 1. Design bearing capacity of material below shallow foundations; periodic.
  - 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
  - 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
  - 4. Subgrade, prior to placement of compacted fill; periodic.
- B. Testing: Classify and test excavated and compacted fill material; periodic.

### 3.5 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

- A. Sprayed Fire Resistant Materials, General:
  - 1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies shown in the approved contract documents, and with the applicable requirements of the building code.
  - 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
- B. Physical and visual tests: Verify compliance with fire resistance rating.
  - 1. Condition of substrates; periodic.
  - 2. Thickness of sprayed fire resistant material; periodic.
  - 3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
  - 4. Bond strength (adhesion and cohesion); periodic.
  - 5. Condition of finished application; periodic.
- C. Structural member surface conditions:
  - 1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
  - 2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.
- D. Application:

1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
  2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
- E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
1. Minimum Allowable Thickness: Tested according to ASTM E605, periodic.
    - a. Design thickness 1 inch or greater: Design thickness minus 1/4 inch.
    - b. Design thickness greater than 1 inch: Design thickness minus 25 percent.
  2. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605 with no less than four measurements per 1,000 square feet of sprayed area on each story of the structure or portion thereof; periodic.
  3. Structural Members: Test according to ASTM E605. Test no less than 25 percent of structural members on each story of the structure or portion thereof; periodic.
- F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.
- G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736 and as described below.
- 3.6 SPECIAL INSPECTIONS FOR INTUMESCENT FIRE RESISTANT COATINGS
- A. Verify intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating shown on the approved contract documents.
- 3.7 SPECIAL INSPECTIONS FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)
- A. Verify water resistive barrier coating applied over sheathing complies with ASTM E2570.
- 3.8 SPECIAL INSPECTIONS FOR SMOKE CONTROL
- A. Test smoke control systems as follows:
1. Record device locations and test system for leakage after erection of ductwork but before starting construction that conceals or blocks access to system.
  2. Test and record pressure difference, flow measurements, detection function and controls after system is complete and before structure is occupied.
- 3.9 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES
- A. Special Inspection Agency shall:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified reference standards.
  3. Ascertain compliance of materials and products with requirements of Contract Documents.
  4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
  5. Perform additional tests and inspections required by Architect.
  6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

### 3.10 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
  2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to work to be tested or inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
    - c. To facilitate tests or inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
  5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.



# Statement of Special Inspections

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Project:

Location:

Owner:

Design Professional in Responsible Charge:

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural      ☐ Mechanical/Electrical/Plumbing  
☒ Architectural      ☐ Other: \_\_\_\_\_

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency:

or ☐ per attached schedule.

Prepared by:

\_\_\_\_\_  
(type or print name)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

*Design Professional Seal*

Owner's Authorization:

Building Official's Acceptance:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**CASE Form 101** • Statement of Special Inspections • ©CASE 2004

# Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☒ Precast Concrete
- ☒ Masonry
- ☒ Structural Steel
- ☐ Cold-Formed Steel Framing

- ☒ Spray Fire Resistant Material
- ☐ Wood Construction
- ☐ Exterior Insulation and Finish System
- ☐ Mechanical & Electrical Systems
- ☐ Architectural Systems
- ☐ Special Cases

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. <b>Special Inspection Coordinator</b>		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

Item	Agency # (Qualif.)	Scope
1. Shallow Foundations	PE/GE	<p><i>Inspect soils below footings for adequate bearing capacity and consistency with geotechnical report.</i></p> <p><i>Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill</i></p>
2. Controlled Structural Fill	PE/GE	<p><i>Perform sieve tests (ASTM D422 &amp; D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.</i></p> <p><i>Inspect placement, lift thickness and compaction of controlled fill.</i></p> <p><i>Test density of each lift of fill by nuclear methods (ASTM D2922)</i></p> <p><i>Verify extent and slope of fill placement.</i></p>

Item	Agency # (Qualif.)	Scope
1. Mix Design	ACI-CCI ICC-RCSI	<i>Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design.</i>
2. Material Certification		
3. Reinforcement Installation	ACI-CCI ICC-RCSI	<i>Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters</i>
4. Welding of Reinforcing	AWS-CWI	<i>Visually inspect all reinforcing steel welds. Verify weldability of reinforcing steel. Inspect preheating of steel when required.</i>
5. Anchor Rods		<i>Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors.</i>
6. Concrete Placement	ACI-CCI ICC-RCSI	<i>Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.</i>
7. Sampling and Testing of Concrete	ACI-CFTT ACI-STT	<i>Test concrete compressive strength (ASTM C31 &amp; C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).</i>
8. Curing and Protection	ACI-CCI ICC-RCSI	<i>Inspect curing, cold weather protection and hot weather protection procedures.</i>

Item	Agency # (Qualif.)	Scope
1. Plant Certification / Quality Control Procedures <input type="checkbox"/> Fabricator Exempt	ACI-CCI ICC-RCSI	Review plant operations and quality control procedures.
2. Mix Design	ACI-CCI ICC-RCSI	Inspect concrete batching operations and verify compliance with approved mix design
3. Material Certification		
4. Reinforcement Installation	ACI-CCI ICC-RCSI	Inspect size, spacing, position and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials.
5. Prestress Operations	ICC-PCSI	Inspect placement, stressing, grouting and protection of prestressing tendons
6. Connections / Embedded Items		
7. Formwork Geometry		
8. Concrete Placement	ACI-CCI ICC-RCSI	Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated .
9. Sampling and Testing of Concrete	ACI-CFTT ACI-STT	Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).
10. Curing and Protection	ACI-CCI ICC-RCSI	Inspect curing, cold weather protection and hot weather protection procedures.
11. Erected Precast Elements	PE/SE	Inspect erection of precast concrete including member configuration, connections, welding and grouting.

Item	Agency # (Qualif.)	Scope
1. Material Certification		
2. Mixing of Mortar and Grout	ICC-SMSI	<i>Inspect proportioning, mixing and retempering of mortar and grout.</i>
3. Installation of Masonry	ICC-SMSI	<i>Inspect size, layout, bonding and placement of masonry units.</i>
4. Mortar Joints	ICC-SMSI	<i>Inspect construction of mortar joints including tooling and filling of head joints.</i>
5. Reinforcement Installation	ICC-SMSI AWS-CWI	<i>Inspect placement, positioning and lapping of reinforcing steel.</i> <i>Inspect welding of reinforcing steel.</i>
6. Grouting Operations	ICC-SMSI	<i>Inspect placement and consolidation of grout. Inspect masonry clean-outs for high-lift grouting.</i>
7. Weather Protection	ICC-SMSI	<i>Inspect cold weather protection and hot weather protection procedures. Verify that wall cavities are protected against precipitation.</i>
8. Evaluation of Masonry Strength	ICC-SMSI	<i>Test compressive strength of mortar and grout cube samples (ASTM C780).</i> <i>Test compressive strength of masonry prisms (ASTM C1314).</i>
9. Anchors and Ties	ICC-SMSI	<i>Inspect size, location, spacing and embedment of dowels, anchors and ties.</i>
10. Anchors and Ties	ICC-SMSI	<i>Inspect size, location, spacing and embedment of dowels, anchors and ties.</i>



Item	Agency # (Qualif.)	Scope
1. Fabricator Certification/ Quality Control Procedures <input type="checkbox"/> Fabricator Exempt	AWS/AISC- SSI ICC-SWSI	Review shop fabrication and quality control procedures.
2. Material Certification	AWS/AISC- SSI ICC-SWSI	Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes
3. Open Web Steel Joists		Inspect installation, field welding and bridging of joists.
4. Bolting	AWS/AISC- SSI ICC-SWSI	Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip-critical connections.
5. Welding	AWS-CWI  ASNT	Visually inspect all welds. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds.  Ultrasonic testing of all full-penetration welds.
6. Structural Details	PE/SE	Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.
7. Metal Deck	AWS-CWI	Inspect welding and side-lap fastening of metal roof and floor deck.

## Spray-Applied Fire Resistant Material

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Item	Agency # (Qualif.)	Scope
1. Material Specifications		
2. Laboratory Tested Fire Resistance Design	ICC-SFSI	<i>Review UL fire resistive design for each rated beam, column, or assembly.</i>
3. Schedule of Thickness	ICC-SFSI	<i>Review approved thickness schedule.</i>
4. Surface Preparation	ICC-SFSI	<i>Inspect surface preparation of steel prior to application of fireproofing</i>
5. Application	ICC-SFSI	<i>Inspect application of fireproofing.</i>
6. Curing and Ambient Condition	ICC-SFSI	<i>Verify ambient air temperature and ventilation is suitable for application and curing of fireproofing.</i>
7. Thickness	ICC-SFSI	<i>Test thickness of fireproofing (ASTM E605). Perform a set of thickness measurements for every 1,000 SF of floor and roof assemblies and on not less than 25% of rated beams and columns.</i>
8. Density	ICC-SFSI	<i>Test the density of fireproofing material (ASTM E605).</i>
9. Bond Strength	ICC-SFSI	<i>Test the cohesive/adhesive bond strength of fireproofing ASTM E736). Perform not less than one test for each 10,000 SF.</i>

END OF SECTION 014533



## SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions of the Contract for Construction and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection of facilities.
- B. Related Sections include the following:
  - 1. Division 01 Section "Multiple Contract Summary" for division of responsibilities for temporary facilities and controls.
  - 2. Divisions 02 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

#### 1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

#### 1.4 USE CHARGES

- A. Use Owner's existing utilities at no additional or change in contract sum.
- B. Water Service: Contractor shall provide connection to Owner's existing water system as available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations using backflow preventer. Removal by same.
- C. Electric Power Service: Contractor shall provide power from Owner's existing system as available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations. Removal by same.
- D. Each Contractor and their Subcontractors shall take measures to conserve water, electric consumption and use of utilities.

#### 1.5 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, and staging areas.

#### 1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Pavement: Comply with Division 32 Section "Bituminous Concrete Paving."
- B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 8 feet (2.4 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails. Provide dust screen along all fencing.
- C. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gauge, galvanized steel, chain-link fabric fencing; minimum 8 feet (2.4 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts. Provide dust screen along all fencing.
- D. Lumber and Plywood: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."
- E. Gypsum Board: Minimum 5/8 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; fire rated-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- G. Paint: Comply with requirements in Division 09 painting Sections.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

### 2.3 EQUIPMENT

- A. Fire Extinguishers: Contractor shall provide portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, Contractor shall provide temporary heat as may be required. Temporary heat shall be provided to assure that the work of all trades can continue through the winter months. This includes temporary heating equipment, fuel, fire watch, necessary labor/supervision, ventilation, temporary enclosures etc. In no case shall the temperature be less than 50 degrees F. Temporary heating plants using electric power as an energy source can be used with prior authorization by the Architect/CM/Owner/

- C. The Contractor shall submit to the owner the equipment to be used for approval prior to the commencement of work.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### 3.2 SHRINK-WRAPPING OF CONSTRUCTION AREAS FOR WINTER CONDITIONS

- A. In areas of work that shall be exposed during cold weather, seal the openings with shrink-wrap plastic and provide a sealed, watertight condition. Provide intermediate supports and/or scaffolding if required due to the size of the opening. If temporary door(s) is/are required frame accordingly and then wrap around the door.

#### 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Contractor for General Construction provides temporary utilities to remove effluent lawfully.
- C. Water Service: Plumbing Contractor shall use Owner's existing water service facilities, if facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  - 1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- D. Sanitary Facilities: Contractor for General Construction shall provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. The location of the temporary toilets must be submitted to the owner for approval prior to the commencement of work.



- E. HEATING: Contractor for General Construction shall provide temporary heating as required by all Trades, for the execution of construction activities, for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity for both interior construction and exterior construction activities, from October 15<sup>th</sup> to April 15<sup>th</sup> which is the traditional heating season. Select equipment that will not have a harmful effect on completed installations or elements being installed.

Building Temporary Heat:

Refer to Multiple Contract Summary 01 10 10 for additional information on providing Building Temporary Heat.

- F. Ventilation and Humidity Control: Contractor for General Construction shall provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Contractor shall use of Owner's existing electric power service, as long as equipment is maintained in a condition acceptable to Owner.
- H. Electric Power Service: Contractor shall provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Connect temporary service to Owner's existing power source, as directed by Owner.
- I. Lighting: Contractor shall provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

### 3.4 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
  2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Paved Areas: Construct and maintain temporary paved areas adequate for construction operations. Locate temporary paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  2. Maintain access for fire-fighting equipment and access to fire hydrants.

- D. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted. Installation and removal by Contractor at no additional cost to Owner.
  - 1. Provide temporary, directional signs for construction personnel and visitors.
  - 2. Maintain and touchup signs so they are legible always.
- E. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. Existing Stair Usage: Use of at least one of Owner's existing stairs will be permitted, if stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
  - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.
- I. Exiting elevator(s) are not to be used by the contractors for transporting any materials and equipment.

### 3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with Article 4 of the General Conditions for Contractor's use of site.
  - 2. Comply with work restrictions specified in Division 01 Section "Summary of Work."
- B. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner and Construction Manager each with one set of keys.
- C. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

- E. Covered Walkways / Sidewalk Sheds: Contractor is to provide walkways and sheds as indicated on the drawings. Structures are to be designed, stamped & signed by an actively licensed, in the State of New York, Architect or Engineer. Submit stamped and signed plans and specifications for record. System is to be erected and maintained by a New York State licensed scaffolding contractor. Electrical Contractor is to provide temporary lighting within the Sheds as per code. No exposed wires shall be accepted, all wires are to be placed within conduits. Lights shall be protected by wire cages.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating is needed and permanent enclosure is not complete, insulate temporary enclosures.
- G. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
  - 1. Construct dustproof and fire rated partitions with 5/8" type 'x' gypsum wallboard with joints taped on both sides. Paint occupied side of partition.
  - 2. Construct dustproof partitions with 1 layer of 4-mil (0.09-mm) polyethylene sheet on each side. Cover floor with 1 layer of 4-mil (0.09-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
  - 3. Sound Insulate partitions to provide noise protection to occupied areas.
  - 4. Seal joints and perimeter. Equip partitions with dustproof HM doors and frames with security locks.
  - 5. Protect air-handling equipment, heating equipment, casework and carpeting.
  - 6. Weather strip openings.
  - 7. Provide walk-off mats at each entrance through temporary partition.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  - 1. Prohibit smoking in construction areas.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
- I. Temporary Protection of Existing Life Safety & Security Equipment: Install and maintain protection of existing equipment within the Areas of Work (i.e. Smoke Detectors, Strobes, etc.). This includes temporarily supporting the equipment so it remains functional.
  - 1. Smoke detectors need to remain functional – cover daily in areas of work, once work day is over uncover OR disable daily in areas of work, once work day is over re-engage. If adjacent smoke detectors outside of the work area are impacted by disabling than that option will not be allowed.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Replace damaged street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  - 3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."
- D. Site Restoration: Restore all areas disturbed on the site to original condition.
  - 1. Restore grass areas.
  - 2. Replace damaged asphalt paving
  - 3. Replace damaged walkways
  - 4. Replace landscaping that has been damaged.

END OF SECTION 015000



## SECTION 017300 – EXECUTION REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 1 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.



- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### 3.04 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.06 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.07 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.08 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.09 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

## SECTION 017310 – CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

#### 1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

#### 1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

### 3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
3. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
4. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
- b. Restore damaged pipe covering to its original condition.

3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017310





## SECTION 017419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:

1. Disposing of nonhazardous demolition and construction waste.

#### 1.02 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### 1.03 SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three (3) copies of report. Include separate reports for demolition and construction waste. Include the following information:
1. Material category.
  2. Generation point of waste.
  3. Total quantity of waste in tons.
  4. Quantity of waste salvaged, both estimated and actual in tons.
  5. Quantity of waste recycled, both estimated and actual in tons.
  6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

- B. Waste Reduction Calculations: Before request for Substantial Completion, submit three (3) copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

#### 1.04 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Waste Management Conference: Conduct conference at Project site.

#### 1.05 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification and waste reduction work plan.[ Include separate sections in plan for demolition and construction waste.] Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.

4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Forms: Prepare waste management plan on forms included at end of Part 3.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect and Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  1. Distribute waste management plan to everyone concerned within five (5) days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

### 3.02 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until installation.
  4. Protect items from damage during transport and storage.
  5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Protect items from damage during transport and storage.

### 3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

### 3.04 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch size.
- B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  1. Pulverize masonry to maximum 3/4-inch size.
  2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
  1. Structural Steel: Stack members according to size, type of member, and length.
  2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
  1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- L. Plumbing Fixtures: Separate by type and size.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Lighting Fixtures: Separate lamps by type and protect from breakage.
- O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- P. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.05 RECYCLING CONSTRUCTION WASTE

#### A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

2. Polystyrene Packaging: Separate and bag materials.
  3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.
- C. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.06 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419



## SECTION 017700 – CLOSE-OUT PROCEDURES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Refer to Article 15 of the General Conditions for additional requirements.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 1 Section "Photographic Documentation" for submitting Final Completion construction photographs and negatives.
  - 2. Divisions 2 through 26 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  - 6. Complete final cleaning requirements, including touchup painting.

7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.04 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment.
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  2. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.

- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.

## 1.06 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Final Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
  - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - g. Remove labels that are not permanent.
  - h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

## SECTION 017823 – OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

#### 1.02 CLOSEOUT SUBMITTALS

- A. Per Article 15 of the General Conditions, prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.
- B. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- D. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of

receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- C. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority.
  - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.02 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.



2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.03 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.04 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:

1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## 2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.

2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
  - G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
  - H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## PART 3 - EXECUTION

### 3.01 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  1. Do not use original project record documents as part of operation and maintenance manuals.

- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 – PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Per Article 15 of the General Conditions, prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.
- B. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- C. Related Sections include the following:
  - 1. Division 1 Section "Summary of Multiple Contracts" for coordinating Project Record Documents covering the Work of multiple contracts.
  - 2. Division 1 Section "Closeout Procedures" for general closeout procedures.
  - 3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 4. Divisions 2 through 26 Sections for specific requirements for Project Record Documents of the Work in those Sections.

#### 1.03 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one (1) set(s) of marked-up Record Prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Final Submittal: Submit one (1) set(s) of marked-up Record Prints, one (1) set(s) of Record Transparencies, and four (4) copies printed from Record Transparencies. Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one copy (1) of Project's Specifications, including addenda and contract modifications.

- C. Record Product Data: Submit five (5) copies of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

## PART 2 - PRODUCTS

### 2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.



- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
  2. Refer instances of uncertainty to Architect for resolution.
  3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
  4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
  2. Format: DWG Version, operating in Microsoft Windows operating system.
  3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
  4. Refer instances of uncertainty to Architect for resolution.
  5. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
    - a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps.

Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:
  - a. Project name.
  - b. Date.
  - c. Designation "PROJECT RECORD DRAWINGS."
  - d. Name of Architect.
  - e. Name of Contractor.

## 2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  5. Note related Change Orders and Record Drawings where applicable.

## 2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and Record Drawings where applicable.

## 2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 3 - EXECUTION

### 3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and DPMC Representative reference during normal working hours.

END OF SECTION 017839



## SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. OPR and BoD documentation prepared by Owner and Architect contains requirements that apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. Related Sections include the following:
  - 1. Division 23 for specific requirements for commissioning HVAC systems.

#### 1.3 DEFINITIONS

- A. BoD: Basis of Design.
- B. CxA: Commissioning Authority.
- C. OPR: Owner's Project Requirements.
- D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- E. TAB: Testing, Adjusting, and Balancing.

#### 1.4 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Engineer/Architect/Project Management Firm.
- B. Members Appointed by Owner:
  - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. In this project, Architect/Engineer/Project Management Firm will oversee the commissioning process.
  - 2. Representatives of the facility user and operation and maintenance personnel.

3. Architect and engineering design professionals.

#### 1.5 OWNER'S RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Demonstration of operation of systems, subsystems, and equipment.
- B. Provide utility services required for the commissioning process.
- C. Provide the BoD documents, prepared by Architect and approved by Owner, to each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

#### 1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Provide utility services required for the commissioning process.
- B. Each Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in construction-phase coordination meetings.
  2. Participate in maintenance orientation and inspection.
  3. Participate in operation and maintenance training sessions.
  4. Participate in final review at acceptance meeting.
  5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
  6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  7. Review and approve final commissioning documentation.
- C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in construction-phase coordination meetings.
  2. Participate in maintenance orientation and inspection.
  3. Participate in procedures meeting for testing.
  4. Participate in final review at acceptance meeting.

5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Architect/Engineer/Project Management Firm for incorporation into the commissioning plan. Update schedule on a weekly basis (or as agreed) throughout the construction period.
6. Provide information to the Architect/Engineer/Project Management Firm for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the Architect/Engineer/Project Management Firm, as specified in Division 1 Section "Operation and Maintenance Data."
9. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

#### 1.7 ARCHITECT/ENGINEER/PROJECT MANAGEMENT FIRM RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Review and comment on submittals from each Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BoD.
- C. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- D. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BoD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
- E. Prepare Project-specific test and inspection procedures and checklists.
- F. Schedule, direct, witness, and document tests, inspections, and systems startup.
- G. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- H. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
- I. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 1 Section "Project Record Documents."
- J. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 1 Section "Operation and Maintenance Data."



- K. Prepare operation and maintenance training program. Operation and maintenance training is specified in Division 23.

## 1.8 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, Architect/Engineer/Project Management Firm shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 23 perform the following:
  - 1. Review the BoD.
  - 2. Review installed systems, subsystems, and equipment.
  - 3. Review instructor qualifications.
  - 4. Review instructional methods and procedures.
  - 5. Review training module outlines and contents.
  - 6. Review course materials (including operation and maintenance manuals).
  - 7. Inspect and discuss locations and other facilities required for instruction.
  - 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  - 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 23.

END OF SECTION 019113

## SECTION 024119 – SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:

- 1. Removal and demolition of selected items from selected areas of the building as indicated on the drawings.

- B. Related Sections include the following:

- 1. Division 1 Section "Summary of Work" for use of premises, and phasing, and Owner-occupancy requirements.
  - 2. Division 1 Section "Photographic Documentation" for preconstruction photographs taken before selective demolition operations.
  - 3. Division 1 Section "Construction Waste Management" for disposal of demolished materials.
  - 4. Division 1 Section "Cutting and Patching" for cutting and patching procedures.

#### 1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated to provide a full and complete system.

#### 1.04 SUBMITTALS

- A. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with Division 1 Section "Photographic Documentation." Submit before Work begins.

#### 1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 4. Review areas where existing construction is to remain and requires protection.

#### 1.06 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
  - 1. Comply with requirements specified in Division 1 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Contractor shall be required to remove and dispose of lead paint if encountered as specified in Section 1.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations. Contractor is responsible to call for markouts prior to demolition activities. Coordinate with installation of all new building services in accordance with the drawings and specifications.

#### PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
  - 1. Comply with requirements specified in Division 1 Section "Photographic Documentation."
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.02 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Cover and protect equipment that have not been removed.

### 3.03 SELECTIVE DEMOLITION, GENERAL

- A. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

### 3.04 DISPOSAL OF DEMOLISHED MATERIALS

A.General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.05 CLEANING

A.Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 024120 – SITE DEMOLITION

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section Includes:

1. Required demolition as indicated on the drawings.

#### 1.02 SUBMITTALS

A. Proposed Demolition Activities:

1. Submit proposed schedule of demolition activities. Indicate:
  - a. Starting and ending dates for each activity as appropriate.
  - b. Interruption and restoration of utility services.
2. Submit proposed methods of operations.
3. Submit proposed dust control measures.
4. Submit proposed noise control measures.

B. Photographs: Before starting work, file with the architect photographs documenting existing conditions that later could be mistaken for damage caused by demolition operations.

C. Submit certificate stating that the required engineering survey has been performed.

D. Project Record Documents:

1. Identify location of capped utilities.
2. Indicate unanticipated structural, electrical, or mechanical conditions.

#### 1.03 QUALITY ASSURANCE (NOT USED)

#### 1.04 PROJECT CONDITIONS

A. Occupancy:

1. Demolition will occur while school is in session.

B. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate fully and submit an accurate, detailed, written report to the engineer. While awaiting the architect's response, reschedule operations if necessary to avoid delay of overall project.

#### 1.05 SEQUENCING AND SCHEDULING

- A. Arrange schedule so as not to interfere with the owner's operations.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that utilities to be disturbed during construction have been disconnected and sealed.
- B. Survey existing conditions and correlate with drawings and specifications to determine extent of demolition required.
- C. Insofar as is practicable, arrange operations to reveal unknown or concealed structural conditions for examination and verification before removal or demolition.
- D. Perform continuing surveys as the work progresses to detect hazards resulting from demolition or construction activities.

### 3.02 PREPARATION

- A. Traffic: Do not obstruct walks or public ways without the written permission of governing authorities and of the owner. Where routes are permitted to be closed, provide alternate routes if required.
- B. Protection:
  - 1. Provide for the protection of persons passing around or through the area of demolition.
  - 2. Perform demolition so as to prevent damage to adjacent improvements and facilities to remain.
  - 3. Provide protective measures to ensure free and safe passage of persons to and from occupied areas.
  - 4. Erect temporary protection such as walks, fences, railings, canopies, etc., where required by authorities having jurisdiction.
  - 5. Protect other new or existing work from damage during demolition operations.
  - 6. Protect existing site appurtenances, landscaping and specimen trees to remain.
- C. Damages: Without cost to the owner and without delay, repair any damages caused to facilities to remain.

### 3.03 UTILITY SERVICES

- A. Arrange with utility companies and shut off any utilities to be disturbed during construction.



- B. Disconnect and cap indicated utilities before starting demolition operations.
- C. Identify location of capped utilities on project record documents.
- D. No interruption of utilities will be permitted.
  - 1. Provide temporary utilities when existing utilities are interrupted.

#### 3.04 EXPLOSIVES

- A. Do not use explosives.

#### 3.05 POLLUTION CONTROLS

- A. Control as much as practicable the spread of dust and dirt.
- B. Observe environmental protection regulations.
- C. Do not allow water usage that results in freezing or flooding.
- D. Do not allow adjacent improvements to remain to become soiled by demolition operations.

#### 3.06 DEMOLITION - GENERAL

- A. Remove: Unless items are otherwise indicated to be reinstalled or salvaged, remove and scrap.
- B. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare for service; reinstall in the same location (or in the location indicated).
- C. Remove and Install New: Remove and dispose of items indicated and install new items in the same location (or in the location indicated).
- D. Remove and Salvage: Items indicated to be salvaged will remain the owner's property. Carefully remove and clean items indicated to be salvaged; pack or crate to protect against damage; identify contents of containers; deliver to the locations indicated.
- E. Remove and Scrap: Remove and dispose of items indicated.
  - 1. All demolished or removed items and materials shall be considered scrap except for those indicated to remain, those indicated to be reinstalled, and those indicated to be salvaged.
  - 2. Items of value to the contractor:
    - a. The contractor may provide for temporary storage on site, if approved by the engineer.
    - b. Remove all items from site when requested by the architect or the owner.
    - c. On-site sale of removed items is prohibited.
- F. Existing to Remain: Construction or items indicated to remain shall be protected against damage during demolition operations. Where practicable, and with the engineer's permission, the contractor may elect to remove items to a suitable storage location during demolition and then properly clean and reinstall the items.

- G. Perform work in a systematic manner.
- H. Demolish and remove existing construction only to the extent required by new construction and as indicated in the contract documents.
- I. Perform selective demolition using methods which are least likely to damage work to remain and which will provide proper surfaces for patching.
- J. Remove debris daily.
- K. Use any methods permitted by governing regulations and the requirements of the contract documents.

### 3.07 DEMOLITION ON OR BELOW GRADE

- A. Where portions of concrete slabs-on-grade are to be removed, first outline the portion with a concrete saw to a depth of at least 1 inch.
- B. Remove concrete slabs-on-grade.
- C. Completely remove below-grade construction, including foundations and footings.

### 3.08 FILLING BELOW-GRADE AREAS AND VOIDS

- A. Completely fill below-grade areas and voids resulting from demolition of structures.
- B. Use only clean, non-frozen, and approved soil material stone, gravel, or sand that is free from deleterious materials.
- C. Do not place fill on saturated or frozen grade, frost, or deleterious material.
- D. Place fill materials in 6 inch loose lifts and compact at optimum moisture content to original density of adjacent ground.
- E. Grade completed surface to drain and to meet adjacent contours.

### 3.09 DISPOSAL OF DEMOLISHED MATERIALS

- A. Promptly dispose of materials resulting from demolition operations. Do not allow materials to accumulate on site.
- B. Transport materials resulting from demolition operations and legally dispose of off-site.
- C. Do not burn removed materials on project site.
- D. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

### 3.10 CLEANING

- A. Remove tools and equipment. Dispose of scrap.
- B. Leave exterior areas free of debris.

END OF SECTION 024120

**SECTION 020800  
ASBESTOS ABATEMENT PROCEDURES**

AT: CHATSWORTH ELEMENTARY SCHOOL –  
2019 BOND REFERENDUM  
34 CHATSWORTH AVENUE  
LARCHMONT, NEW YORK 10538  
SED # 66-07-01-03-0-005-020

OWNER: MAMARONECK UFSD  
1000 W. BOSTON POST ROAD  
MAMARONECK, NEW YORK 10543  
PH. (914) 220-3081  
FX. (914) 220-3085

CONSULTANT: QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC. (QUES&T)  
1376 ROUTE 9  
WAPPINGERS FALLS, NEW YORK 12590  
PH. (845) 298-6031  
FX. (845) 298-6251



**SPECIFICATION DATED: January 10, 2020**

**PART I – GENERAL**

**1.01 DESCRIPTION**

- A. All work under this contract shall be performed in strict accordance with the specifications and all applicable laws for asbestos removal projects. The Abatement Contractor shall furnish all labor, materials, supervision, services, insurance and equipment necessary for the complete and total removal of Asbestos-containing Materials (ACM) as described herein, in attachments to the specification, Job Specific Variance(s) and/or as directed by Mamaroneck UFSD (here-in-after the "Owner") and/or the Owners Representative(s) to support the to the following Mamaroneck UFSD projects:
- Chatsworth Elementary School –  
2019 Bond Referendum  
34 Chatsworth Avenue  
Larchmont, New York 10538  
SED # 66-07-01-03-0-005-020
- B. Abatement Contractor shall provide for personnel air monitoring to satisfy OSHA regulation 29 CFR Parts 1926.1101(f). All work performed shall be in strict accordance with applicable provisions and regulations promulgated under New York State Department of Labor, Industrial Code 56 (ICR-56).
- C. The Abatement Contractor shall satisfy the requirements for asbestos projects issued by the New York State Department of Labor concerning licensing and certification; notification; equipment; removal and disposal procedures; engineering controls; work area preparation; decontamination and clean-up procedures; and personnel air monitoring.
- D. The Abatement Contractor shall be responsible for submittal of asbestos project notification(s) and applicable fees to EPA and NYSDOL concerning this project. Project notification(s) shall be made for the cumulative total of ACM to be removed as required by ICR-56-3.4. Work practices for each individual work area established shall be consistent with the quantity of ACM contained within that work area as defined in ICR-56-2.
- E. The scope of work under this contract shall include the following:
1. All asbestos-containing materials (ACM) shall be removed in accordance with these specifications. The Abatement Contractor is responsible for field verification of estimated quantities, locations and other site conditions that may affect work.
  2. All fixed objects remaining within the work area(s) shall be protected as required by Title 12 NYCRR Section 56-7.10(b) and as described in these specifications.
  3. The containerization, labeling and disposal of all asbestos waste in accordance with applicable city, state and federal regulations and these specifications.
  4. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to, ceiling tiles, ceiling finishes, wall finishes and/or floor finishes, etc.
  5. The Abatement Contractor shall be responsible for any and all demolition required to access materials identified in scope of work and on associated drawings.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

6. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner(s) immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. If the Abatement Contractor removes additional asbestos prior to the order to proceed the additional work will not be acknowledged.
7. Permissible working hours shall be Monday through Friday 7:00 A.M. to 4:00 P.M. with one (1) hour for lunch and/or as defined by the Owner. Holidays shall be considered weekends and not included for working days. Upon written approval from the Owner, the Abatement Contractor may work past these hours. The Abatement Contractor will incur any and all costs associated for work performed beyond the defined schedule including, but not limited to: abatement activities, project/air monitoring, custodial/staffing labor, overtime, mobilizations, etc.
8. Buildings will be turned over to the Abatement Contractor as is. At that time, all electrical services and HVAC systems in the proposed work areas will be shut down. Electricity and water supply will be maintained in the building for use by the Abatement Contractor. The Abatement Contractor is responsible for securing all power in the work area(s) and establishing all temporary GFCI hookups necessary to complete his work.
9. The Abatement Contractor shall remove identified asbestos-containing floor coverings to the building substrate beneath; in areas indicted. Subsequent to final air clearances, the substrate(s) shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
10. The Abatement Contractor must coordinate location of waste containers with the Facility and the Owner. Deliveries and storage of equipment must be coordinated with the Facility and the Owner.
11. All “Large” and “Small” asbestos abatement projects, as defined by 12 NYCRR56 shall not be performed while the building is occupied. The term “building” means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exists that do not pass through the occupied portion(s) and ventilation systems must be physically separated and sealed at the isolation barriers.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 1.02 PRE-CONTRACT SUBMITTALS

Within three (3) days after bids are opened, the three (3) apparent low bidders shall be required to submit the following documentation:

#### A. Resume': Shall include the following:

1. Provide a list of projects of similar nature performed within the past two (2) years and include the dollar value of all projects. Provide project references to include owner, consultant, and air monitoring firms' name, contact person, address, and phone number, include location of project and date of completion.
2. Abatement Contractor license issued by New York State Department of Labor for asbestos work in accordance with ICR-56-3.
3. A list of owned equipment available to be used in the performance of the project.
4. The number of years engaged in asbestos removal.
5. An outline of the worker training courses and medical surveillance program conducted by the Abatement Contractor.
6. A standard operating procedures manual describing work practices and procedures, equipment, type of decontamination facilities, respirator program, special removal techniques, etc.
7. Documentation to the satisfaction of the Owner pertaining to the Abatement Contractor's financial resources available to perform the project. Such data shall include, but not be limited to, the firm's balance sheet for the last fiscal year.

#### B. Citations/Violations/Legal Proceedings

1. Submit a notarized statement describing any citations, violations, criminal charges, or legal proceedings undertaken or issued by any law enforcement, regulatory agency, or consultant concerning performance on previous asbestos abatement contracts. Briefly describe the circumstances citing the project and involved persons and agencies as well as the outcome of any actions.
2. Answer the question: "Has your firm or its agents been issued a Stop Work order on any project within the last two years?" If "Yes" provide details as discussed above.
3. Answer the question: "Are you now, or have you been in the past, a party to any litigation or arbitrations arising out of your performance on Asbestos Abatement Contracts?" If "Yes" provide details as discussed in 1. above.
4. Describe any liquidated damages assessed within the last two years.

#### C. Preliminary Schedule

1. Provide a detailed schedule including work dates, work shift times, estimate of manpower to be utilized and the start and completion date for completion of each major work area.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 1.03 DOCUMENTATION

- A. The Abatement Contractor shall be required to submit the following and receive the Consultant's approval prior to commencing work on this project:
1. Provide documentation of worker training for each person assigned to the project. Documentation shall include copies of each workers valid New York State asbestos handler certificates (for those employees who may perform asbestos removal), documentation of current respirator fit test and current OSHA required training and medical examination.
  2. The attached "Asbestos Employee Medical Examination Statement" and "Asbestos Employee Training Statement" forms shall be completed, signed and submitted for each worker assigned to the project. Records of all employee training and medical surveillance shall be maintained for at least forty (40) years. Copies of the records shall be submitted to the Consultant prior to commencement.
  3. The Abatement Contractor shall submit proof of a current, valid license issued by the New York State Department of Labor pursuant to the authority vested in the Commissioner by section 906 of the Labor Laws, and that the employees performing asbestos related work on this project are certified by the State of New York as required in Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York latest edition. Copies of all licenses shall be submitted prior to the commencement of the project.
  4. The Abatement Contractor shall submit a written respiratory protection program meeting the requirements of 29 CFR 1910.134 to the Consultant.
  5. The name, address, social security number and NYS DOL certificate number of the person(s) who will supervise the asbestos project.
  6. The name and address of the deposit or waste disposal site or sites where the asbestos materials are to be deposited or disposed of. This site must be approved by the Owner. The manifesting procedure must also be specified.
  7. The name, address and New York State Dept. of Environmental Conservation ID Number of any transporters that are to be used to transport waste.
  8. A written Standard Operation Procedure (SOP) that is designed and implemented to maximize protection against human exposure to asbestos dust. The SOP shall take into consideration the workers, visitors, building employees, general public and environment. As a minimum the procedures must include the following:
    - a. Security for all work areas on an around-the-clock basis against unauthorized access.
    - b. Project organization chart including the phone numbers of at least two responsible persons who shall be authorized to dispatch men and equipment to the project in the event of an emergency; including weekends.
    - c. Description of protective clothing and NIOSH approved respirators to be used.
    - d. Description of all removal methods to be used, including HEPA air filtration and decontamination sequence with special emphasis on any procedure that may deviate from these specifications.



## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- e. A list of manufacturers' certificates stating that all vacuums, negative air filtration equipment, respirators and air supply equipment meet OSHA and EPA requirements.
- f. A list of all materials proposed to be furnished and used under this contract.
- g. Emergency evacuation procedures in the event of fire, smoke or accidents such as injury from falling, heat exposure, electrical shock, etc.
- h. The name, address and ELAP number of the New York State Department of Health Certified Analytical Testing Laboratory the Contractor proposes to use for the OSHA monitoring.
- 9. A detailed plan, in triplicate, for the phasing of the project, division of work areas and location of decontamination facilities, waste containers and temporary office.
- 10. Work schedule, identifying firm dates and completion for actual areas. Bar chart or critical path chart indicating phases is required.
- B. The Abatement Contractor shall post their NYS DOL contractor's license and maintain a daily log documenting the dates and time of the following items within each personal decontamination unit:
  - 1. Meetings; purpose, attendants, discussion (brief)
  - 2. Sign-in and sign-out of all persons entering the work area including name, date, time, social security number, position or function and general description of daily activity.
  - 3. Testing of barriers and enclosure systems using smoke tubes prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
  - 4. Inspection of all plastic barriers, twice daily, by the asbestos supervisor.
  - 5. Loss of enclosure integrity; special or unusual events, barrier breaches, equipment failures, etc.
  - 6. Daily cleaning of enclosures.
  - 7. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.
- C. Documentation with confirmation signature of Consultant's representative of the following shall be provided by the Abatement Contractor at the final closeout of the project.
  - 1. Testing of barriers and enclosure systems using smoke tubes shall be performed prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
  - 2. Inspection of all plastic barriers.
  - 3. Removal of all polyethylene barriers.
  - 4. Consultant's inspections prior to encapsulation.
  - 5. Removal of waste materials.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

6. Decontamination of equipment (list items).
  7. Consultant's final inspection/final air tests.
- D. The Abatement Contractor shall provide records of all project information, to include the following which shall be submitted upon completion of the project and prior to approval of the Abatement Contractor's payment application:
1. The location and description of the abatement project.
  2. The name, address and social security number of the person(s) who supervised the asbestos project.
  3. Certified payroll documentation Pursuant to Article 8, Section 220 of the NYS Labor Law
  4. Copies of EPA/NYS DOL Asbestos Certificates for all Workers and Supervisors employed on the Project.
  5. Copies of Medical Approval and Respirator Fit-testing for all Asbestos Workers and Supervisors employed on the Project.
  6. Copies of Abatement Contractors Daily Sign-In Sheets & Logs for persons entering and leaving the work area. – Title 12 NYCRR Part 56-7.3.
  7. Copies of Abatement Contractor's personal air sampling laboratory results.
  8. The amounts and type of asbestos materials that was removed, enclosed, encapsulated, or disturbed.
  9. The name and address of the deposit or waste disposal site or sites where the asbestos waste materials were deposited or disposed of and all related manifests, receipts and other documentation associated with the disposal of asbestos waste.
  10. The name and address of any transporters used to transport waste and all related manifests, receipts and other documentation associated with the transport of asbestos waste.
  11. All other information that may be required by state, federal or local regulations.
  12. Copy of the Supervisor's Daily Project Log of events as described in 1.03 B, above.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 1.04 NOTIFICATIONS AND PERMITS

A. The Abatement Contractor shall be required to prepare and submit notifications to the following agencies at least ten (10) days prior to the commencement of the project:

1. Asbestos NESHAPS Contact  
U.S. Environmental Protection Agency  
NESHAPS Coordinator, Air Facilities Branch  
26 Federal Plaza  
New York, New York 10007  
(212) 264-7307
2. State of New York Department of Labor  
Division of Safety and Health  
Asbestos Control Bureau  
State Office Building Campus, Building 12, Room 454  
Albany, New York 12240
3. Owner(s): Mamaroneck UFSD  
1000 Boston Post Road  
Mamaroneck, NY 10543  
ATTN: Steve Brugge  
Ph. (914) 220-3081  
Fx. (914) 220-3085  
E-mail. [sbrugge@mamkschools.org](mailto:sbrugge@mamkschools.org)
4. Owner's Representative(s): LAN Associates  
252 Main St  
Goshen, NY 10924  
ATTN: Danielle L. Farrell  
Ph. (845) 615-0350  
Fx. (845) 615-0351  
E-mail. [dlf@lan-nj.com](mailto:dlf@lan-nj.com)
5. Environmental Consultant(s): Quality Environmental Solutions & Technologies, Inc. (QuES&T)  
1376 Route 9  
Wappingers Falls, New York 12590  
ATTN: Laurence Goldstein  
Ph. (845) 298-6031  
Fx. (845) 298-6251  
E-mail. [lgoldstein@qualityenv.com](mailto:lgoldstein@qualityenv.com)

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

B. The notification shall include but not be limited to the following information:

1. Name and address of Owner.
2. Name, address and asbestos handling license number of the Abatement Contractor.
3. Address and description of the building, including size, age, and prior use of the building or area; the amount, in square feet or linear feet of asbestos material to be removed; room designation numbers or other local information where asbestos material is found, including the type of asbestos material (friable or non-friable).
4. Scheduled starting and completion dates for removal.
5. Methods to be employed in abating asbestos containing materials.
6. Procedures and equipment, including ventilating/exhaust systems, that will be employed to comply with the Code of Federal Regulation (CFR) Title 40, Part 61 of the U.S. Environmental Protection Agency.
7. The name and address of the carting company and of the waste disposal site where the asbestos waste will be deposited.

**NOTE:** Notifications shall be submitted using standard forms as may be used by the respective agency.

For DOL (NYS) include "Asbestos Project Notification" form (DOSH-483) with proper fee, if required. For EPA include "Notification of Demolition and Renovation"; 40 CFR Part 61.

- C. The Abatement Contractor shall secure any permits required by the city, town, county, or state that may be required and the cost for obtaining the permit shall be included in his base bid.
- D. The Abatement Contractor shall erect warning signs around the work space at every point of potential entry into the work area in accordance with OSHA 1926.58k (2), (i). These signs shall bear the following information:

**DANGER**  
**CANCER AND LUNG DISEASE HAZARD**  
**AUTHORIZED PERSONNEL ONLY**  
**RESPIRATORS AND PROTECTIVE**  
**CLOTHING**  
**ARE REQUIRED IN THIS AREA**

- E. The Abatement Contractor shall post at entrances to the work place and immediate adjacent areas, notifications to building occupants, which include the name and license number of the contractor, project location and size, amount and type of ACM, abatement procedures, dates of expected occurrence and name and address of the air monitor and laboratory in compliance with ICR 56-3.6.
- F. The Abatement Contractor shall post a list of emergency telephone numbers at the job site which shall include the Owner's Representative, police, emergency squad, local hospital, Environmental Protection Agency, N.Y. State Department of Labor, Occupational Safety and Health Administration and the local Department of Health.

### 1.05 APPLICABLE STANDARDS

Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, applicable standards of the construction industry have the same force and effects (and are made a part of contract documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith. Resolution of overlapping and conflicting requirements, which result from the application of several different industry standards to the same unit of work, shall be by adherence to the most stringent requirement.

A. Applicable standards listed in these Specifications form a part of this Specification and include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

1. ANSI:  
American National Standards Institute  
1430 Broadway  
New York, New York 10018
2. ASHRAE:  
American Society for Heating, Refrigerating  
and Air Conditioning Engineers  
1791 Tullie Circle NE  
Atlanta, Georgia 30329
3. ASTM:  
American Society for Testing and Materials  
1916 Race Street  
Philadelphia, Pennsylvania 19103
4. CFR  
Code of Federal Regulations Available  
from Government Printing Office  
Washington, District of Columbia 20402
5. CGA  
Compressed Gas Association  
1235 Jefferson Davis Highway  
Arlington, Virginia 22202
6. CS  
Commercial Standard of NBS  
(US Dept. of Commerce)  
Government Printing Office
7. EPA  
Environmental Protection Agency, Region II  
26 Federal Plaza  
New York, New York 10007  
Asbestos Coordinator - Room 802  
(212) 264-9538  
Part 61, Sub-Parts A & B  
National Emission Standard for Asbestos

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 8. FEDERAL SPECS

Federal Specification (General Services Administration)  
7th and D Street, SW  
Washington, District of Columbia 20406

### 9. NBS

National Bureau of Standards  
(US Department of Commerce)  
Gaithersburg, Maryland 20234

### 10. NEC

National Electrical Code (by NFPA)

### 11. NFPA

National Fire Protection Association  
Batterymarch Park  
Quincy, Massachusetts 02269

### 12. NIOSH

National Institute for Occupational Safety and Health  
26 Federal Plaza  
New York, New York 10007

### 13. NYSDOH

New York State Department of Health  
Bureau of Toxic Substance Assessment  
Room 359 - 3rd Floor  
Tower Building Empire State Plaza  
Albany, New York 12237

### 14. NYSDEC

New York State Department of Environmental Conservation  
Room 136  
50 Wolf Road  
Albany, New York 12233-3245

### 15. NYSDOL

State of New York Department of Labor  
Division of Safety and Health  
Asbestos Control Program  
State Campus  
Building 12  
Albany, New York 12240

### 16. OSHA

Occupational Safety and Health Administration  
(US Department of Labor)  
New York Regional Office - room 3445  
1515 Broadway  
New York, New York 10036

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 17. UL

Underwriters Laboratories  
333 Pfingsten Road  
Northbrook, Illinois 60062

#### B. Federal Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:

##### 1. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA):

- a. Asbestos Regulations  
Title 29, Part 1910, of the Code of Federal Regulations.
- b. Respiratory Protection  
Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
- c. Construction Industry  
Title 29, Part 1926, of the Code of Federal Regulations.
- d. Access to Employee Exposure & Medical Records  
Title 29, Part 1910, Section 20 of the Code of Federal Regulations.
- e. Hazard Communication  
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
- f. Specifications for Accident Prevention Signs and Tags  
Title 29, Part 1910, section 145 of the Code of Federal Regulations.

##### 2. U.S. Environmental Protection Agency (EPA):

- a. Asbestos Hazard Emergency Response Act (AHERA) Regulation Asbestos Containing Materials in Schools Final Rule & Notice Title 40, Part 763, Subpart E of the Code of Federal Regulations.
- b. Worker Protection Rule  
40 CFR Part 763, Subpart G, CPTS 62044, FLR 2843-9  
Federal Register, Vol. 50, No. 134, 7/12/85, P28530-28540
- c. Regulation for Asbestos  
Title 40, Part 61, Subpart A of the Code of Federal Regulations
- d. National Emission Standard for Asbestos  
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
- e. Resource Conservation and Recovery Act (RCRA) 1976, 1980  
Hazardous and Solid Waste Amendments (HSWA) 1984  
Subtitle D, Subtitle C



## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

3. U.S. Department of Transportation (DOT):
    - a. Hazardous Substances: Final Rule Regulation 49 CFR, Part 171 and 172.
  - C. State Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
    1. New York State Department of Environmental Conservation (DEC) Regulations regarding waste collection registration. Title 6, Part 364 of the New York State Official Compilation of Codes, Rules and Regulations - 6NYCRR 364.
    2. New York State Right-To-Know Law
    3. New York State Department of Labor Asbestos Regulations Industrial Code Rule 56.
    4. NYSDOH Title 10 Part 73 – Asbestos Safety Program and Environmental Laboratory Approval Program.
  - D. Standards: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
    1. American National Standards Institute (ANSI)
      - a. Fundamentals Governing the Design and Operation of Local Exhaust Systems  
Publication Z9.2-79
      - b. Practices for Respiratory Protection  
Publication Z88.2-80
  - E. Guidance Documents: Those that discuss asbestos abatement work or hauling and disposal of asbestos waste materials are listed below only for the Abatement Contractor's information. These documents do not describe the work and are not a part of the work of this contract.
- EPA:
1. Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)  
EPA560/5-85-024.
  2. Asbestos Waste Management Guidance EPA 530-SW-85-007.
- F. Patents and Royalties: The Abatement Contractor shall pay all royalties and/or license fees. The Abatement Contractor shall defend all suits and claims for infringement of any patent rights and save the Owner and Consultant harmless from loss including attorney fees on account thereof.

### 1.06 DEFINITIONS

As used in or in connection with these specifications the following are terms and definitions.

**Abatement** - Procedure to control release from asbestos material. This includes removal, encapsulation and enclosure.

**Aggressive sampling** - A method of sampling in which the person collecting the air sample creates activity by the use of mechanical equipment during the sampling period to stir up settled dust and simulate activity in that area of the building.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

**AIHA** - The American Industrial Hygiene Association, 475 Wolf Ledges Parkway, Akron, Ohio 44311.

**Airlock** - A system for permitting entrance and exit while restricting air movement between a containment area and an uncontaminated area. It consists of two curtained doorways separated by a distance of at least three feet such that one passes through one doorway into the airlock, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway, thereby preventing flow-through contamination.

**Air sampling** - The process of measuring the content of a known volume of air collected during a specific period of time.

**Amended water** - Water to which a surfactant has been added.

**Approved asbestos safety program** - A program approved by the Commissioner of Health providing training in the various disciplines that may be involved in an asbestos project.

**Area air sampling** - Any form of air sampling or monitoring where the sampling device is placed at some stationary location.

**Asbestos** - Any naturally occurring hydrated mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cummingtonite-gunerite), crocidolite (riebeckite), tremolite, anthophyllite and actinolite.

**Asbestos contract** - An oral or written agreement contained in one or more documents for the performance of work on an asbestos project and includes all labor, goods and service.

**Asbestos handler** - An individual who installs, removes, applies, encapsulates, or encloses asbestos or asbestos material, or who disturbs friable asbestos. Only individuals certified by NYS Department of Labor shall be acceptable for work under this specification.

**Asbestos handling certificate** - A certificate issued by the Commissioner of Labor of the State of New York, to a person who has satisfactorily completed an approved asbestos safety program.

**Asbestos project** - Work undertaken by a contractor which involves the installation, removal, encapsulation, application or enclosure of any ACM or the disturbance of friable ACM.

**Asbestos Safety Technician (AST)** - Individual designated to represent the Consultant, perform third party monitoring and perform compliance monitoring at the job site during the asbestos project.

**Asbestos waste material** - Asbestos material or asbestos contaminated objects requiring disposal.

**Authorized visitor** - The building owner, his or her representative or any representative of a regulatory or other agency having jurisdiction over the project.

**Background level monitoring** - A method used to determine ambient airborne concentrations inside and outside of a building or structure prior to starting an abatement project.

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**Building owner** - The person in whom legal title to the premises is vested unless the premises are held in land trust, in which instance Building Owner means the person in whom beneficial title is vested.

**Clean room** - An uncontaminated area or room that is a part of the personal decontamination enclosure with provisions for storage of persons' street clothes and protective equipment.

**Cleanup** - The utilization of HEPA vacuuming to control and eliminate accumulations of asbestos material and asbestos waste material.

**Clearance air monitoring** - The employment of aggressive sampling techniques with a volume of air collected to determine the airborne concentration of residual fibers upon conclusion of an asbestos abatement project.

**Commissioner** - Commissioner of the New York State Department of Labor.

**Contractor** - A company, unincorporated association, firm, partnership or corporation and any owner or operator thereof, which engages in an asbestos project or employs persons engaged in an asbestos project.

**Curtained doorway** - A device that consists of at least three overlapping sheets of plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top and left side, the second sheet at the top and right side, and the third sheet at the top and the left side. All sheets shall have weights attached to the bottom to insure that the sheets hang straight and maintain a seal over the doorway when not in use.

**Decontamination enclosure system** - A series of connected rooms, separated from the work area and from each other by air locks, for the decontamination of persons, materials, equipment, and authorized visitors.

**Encapsulant (sealant) or encapsulating agent** - A liquid material that can be applied to asbestos material and which prevents the release of asbestos from the material by creating a membrane over the surface.

**Enclosure** - The construction of airtight walls, ceilings and floors between the asbestos material and the facility environment, or around surfaces coated with asbestos materials, or any other appropriate procedure that prevents the release of asbestos materials.

**Equipment room** - A contaminated area or room that is part of the personal decontamination enclosure system with provisions for the storage of contaminated clothing and equipment.

**Fixed object** - A unit of equipment, furniture or other fixture in the work area which cannot be readily removed from the work area.

**Friable Asbestos Material** - That condition of crumbled, pulverized, powdered, crushed or exposed asbestos capable of being released into the air by hand pressure.

**Friable material containment** - The encapsulation or enclosure of any friable asbestos material.

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**Glovebag technique** - A method for removing asbestos material from heating, ventilating, and air conditioning (HVAC) ducts, piping runs, valves, joints, elbows, and other nonplanar surfaces in a noncontained work area. The glovebag assembly is a manufactured device consisting of a glovebag constructed of at least six mil transparent plastic, two inward-projecting longsleeve gloves, which may contain an inward projecting waterwand sleeve, an internal tool pouch, and an attached, labeled receptacle or portion for asbestos waste. The glovebag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and to contain all asbestos fibers released during the abatement process.

**HEPA filter** - A high efficiency particulate air filter capable of trapping and retaining 99.97 percent of particulate greater than 0.3 microns equivalent aerodynamic diameter.

**HEPA vacuum equipment** - Vacuuming equipment with a high efficiency particulate air filtration system.

**Holding area** - A chamber in the waste decontamination enclosure located between the washroom and an adjacent uncontaminated area.

**Homogeneous work area** - A site within the abatement work area that contains one type of asbestos material and where one type of abatement is used.

**Large asbestos project** - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 160 square feet or more of asbestos or asbestos material or 260 linear feet or more of asbestos or asbestos material.

**Minor asbestos project** - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material.

**Movable object** - A unit of equipment, furniture or fixture in the work area that can be readily removed from the work area.

**Negative air pressure equipment** - A local exhaust system equipped with HEPA filtration. The system shall be capable of creating and maintaining a negative pressure differential between the outside and the inside of the work area.

**Non-asbestos material** - Any material containing one percent or less asbestos by weight.

**Occupied area** - Any frequented portion of the work site where abatement is not taking place.

**Outside air** - The air outside the building or structure.

**Personal air monitoring** - A method used to determine an individual's exposure to airborne contaminants. The sample is collected outside the respirator in the person's breathing zone.

**Plasticize** - To cover floors, walls, ceilings and other surfaces with 6 mil fire retardant plastic sheeting as herein specified.

**Project** - Any form of work performed in connection with the abatement of asbestos or alteration, renovation, modification or demolition of a building or structure that may disturb asbestos or asbestos material.

**Removal** - The stripping of any asbestos material.

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**Repair** - Corrective action using required work practices to control fiber release from damaged areas.

**Respiratory protection** - Respiratory protection required of licensed asbestos workers and authorized visitors in accordance with the applicable laws.

**Satisfactory clearance air monitoring results** - For all post- abatement samples, airborne concentrations of total fibers that are less than 0.01 fibers per cubic centimeter or background levels, whichever are greater, using phase contrast microscopy (PCM).

**Shower room** - A room between the clean room and the equipment room in the personal decontamination enclosure with hot and cold running water controllable at the top and arranged for complete showering during decontamination.

**Small asbestos project** - An asbestos project involving the installation, removal, disturbances, enclosure, or encapsulation of more than 10 and less than 160 square feet of asbestos or asbestos material of more than 25 and less than 260 linear feet of asbestos or asbestos material.

**Staging area** - The area near the waste transfer airlock where containerized asbestos waste has been placed prior to removal from the work area.

**Surfactant** - A chemical wetting agent added to water to improve its penetration.

**Visible emissions** - An emissions of particulate material that can be seen without the aid of instruments.

**Washroom** - A room between the work area and the holding area in the waste decontamination enclosure system, where equipment and waste containers are wet cleaned and/or HEPA vacuumed.

**Waste decontamination enclosure system** - An area, consisting of a washroom and a holding area, designated for the controlled transfer of materials and equipment.

**Wet cleaning** - The process of eliminating asbestos contamination from surfaces, equipment or other objects by using cloths, mops, or other cleaning tools.

**Work area** - Designated rooms, spaces, or areas where asbestos abatement takes place.

**Work site** - Premises where asbestos abatement is taking place.

**Work Surface** - Substrate surface from which asbestos-containing material has been removed.

### 1.07 UTILITIES, SERVICE AND TEMPORARY FACILITIES

- A. The Owner shall make available to the Abatement Contractor all reasonable amounts of water and electrical power at no charge.
- B. The Abatement Contractor shall provide, at his own expense, all electrical, water, and waste connections, extensions, and construction materials, supplies, etc. All connections must be approved in advance by the Owner and all work relative to the utilities must be in accordance with the applicable building codes.

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- C. The Abatement Contractor shall provide scaffolding, ladders and staging, etc. as necessary to accomplish the work of this contract. The type, erection and use of all scaffolding, ladders and staging, etc. shall comply with all applicable OSHA provisions.
- D. All connections to the Owner's water system shall include reduced pressure backflow protection or double check and double gate valves. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.
- E. The Abatement Contractor shall use only heavy duty abrasion resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water to each work area and to each decontamination unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment. All water must be shut off at the end of each shift.
- F. The Abatement Contractor shall provide service to decontamination unit electrical subpanel with minimum 60 amp, 2 pole circuit breaker or fused disconnect and ground-fault circuit interrupters (GFCI), reset button and pilot light, connected to the building's main distribution panel. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work. This electrical subpanel shall be used for hot water heater, PAPR battery recharging and air sampling pumps.
- G. The Abatement Contractor shall provide UL rated 40-gallon electric hot water heater to supply hot water for the decontamination unit shower. Activate from 30 amp circuit breaker on the electrical subpanel located within the decontamination unit. Provide with relief valve compatible with water heater operation; relief valve down to drip pan on floor with type L copper. Wiring of the hot water heater shall be in compliance with NEMA, NEC, and UL standards.
- H. The Abatement Contractor shall provide identification warning signs at power outlets, which are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 plugs into higher voltage outlets. Dry transformers shall be provided where required to provide voltages necessary for work operations. All outlets or power supplies shall be protected by ground fault circuit interrupter (GFCI) at the power source.
- I. The Abatement Contractor shall use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.
- J. The Abatement Contractor shall provide general service incandescent lamps of wattage indicated or required for adequate illumination; Protect lamps with guard cages or tempered glass enclosures; Provide exterior fixtures where fixtures are exposed to moisture.
- K. The Abatement Contractor shall provide temporary heat or air conditioning as necessary to maintain comfortable working temperatures inside and immediately outside the work areas. Heating and A/C equipment shall have been tested and labeled by UL, FM or another recognized trade association related to the fuel being used. Fuel burning heaters shall not be used inside containment areas. The Contractor shall also provide a comfortable working environment for occupied areas that are impacted by the asbestos removal.
- L. The Abatement Contractor shall comply with recommendations of the NFPA standard in regard to the use and application of fire extinguishers. Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher in each work area, equipment room, clean room and outside the work area

## **1.08 REMOVAL OF FIXTURES**

- A. In locations where the Abatement Contractor is directed to dispose of fixtures he shall either decontaminate the fixtures and dispose of them as non-asbestos containing materials or he shall place them in an appropriate container and dispose of them as asbestos containing material.
- B. In locations where the Abatement Contractor is directed to remove and reinstall fixtures, the fixtures shall be removed, decontaminated, labeled, protected with plastic and stored by the contractor in a location as directed by the Owner.
- C. Upon completion of the asbestos removal and upon receiving satisfactory clearance air monitoring results, all items to be replaced shall be restored to their original location and reinstalled by the Abatement Contractor.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS AND EQUIPMENT**

#### **A. GENERAL REQUIREMENTS**

- 1. Materials shall be stored off the ground, away from wet or damp surfaces and under protective cover to prevent damage or contamination.
- 2. Damaged or deteriorating materials shall not be used and shall be removed from the premises.
- 3. Power tools used to drill, cut into, or otherwise disturb asbestos material shall be equipped with HEPA filtered local exhaust ventilation.
- 4. The Abatement Contractor shall make available to authorized visitors, ladders and/or scaffolds of sufficient dimension and quantity so that all work surfaces can be easily and safely reached for inspection. Scaffold joints and ends shall be sealed with tape to prevent incursion of asbestos. Scaffolds and ladders shall comply with all applicable codes.

#### **B. PLASTIC BARRIERS (POLYETHYLENE)**

- 1. In sizes and shapes to minimize the number of joints.
  - a. Six mil. (.006") fire-retardant for vertical protection (walls, entrances and openings).
  - b. Six mil. (.006") fire-retardant for horizontal protection (fixed equipment) and heating grilles.
  - c. Six mil. (.006") reinforced fire-retardant for floors of decon units.
- 2. Provide two (2) layers over all roof, wall and ceiling openings. Floor penetrations shall be sealed with a rigid material prior to plasticizing to prevent tripping and fall hazards. All seams within a layer shall be separated by a minimum distance of six feet and sealed airtight. All seams between layers shall be staggered.
- 3. Barrier Attachment - Commercially available duct tape (fabric or paper) and spray-on adhesive. Duct tape shall be capable of sealing joints of adjacent sheets of plastic, facilitating attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials and adhering under both dry and wet conditions.



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### C. SIGNS

1. Danger signs shall be provided and shall conform to 29 CFR 1926.1101 and be 14" x 20". These signs shall bear the following information:

**DANGER  
ASBESTOS  
CANCER AND LUNG DISEASE HAZARD  
RESPIRATORS AND PROTECTIVE  
CLOTHING  
ARE REQUIRED IN THIS AREA**

### D. DANGER LABELS AND TAPE

1. Labels shall be affixed to any asbestos contaminated material in accordance with the requirements of 29 CFR 1910.1200 (f) of OSHA's Hazard Communication Standard, and shall contain the following information:

**DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID BREATHING DUST  
CANCER AND LUNG DISEASE HAZARD**

2. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 49 CFR Parts 171 and 172, Hazardous Substances; Final Rule (U.S. Department of Transportation), and shall contain the following information:

**RQ HAZARDOUS SUBSTANCE  
SOLID, NOS, ORM-E, NA 9188  
(ASBESTOS)**

3. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 40 CFR Part 61.150, NESHAP; Asbestos; Final Rule (USEPA) and shall contain the name of the waste generator and the location at which the waste was generated.

NOTE: All containers marked as above (1, 2 and 3) shall be disposed of as asbestos waste.

4. Provide 3" red barrier tape printed with black lettered "DANGER ASBESTOS REMOVAL". Locate barrier tape across all corridors, entrances and access routes to asbestos work area.

### E. PROTECTIVE EQUIPMENT

#### 1. Respiratory Requirements

- a. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators are the minimum allowable respiratory protection permitted to be utilized during removal operations.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- b. Where not in violation of NIOSH, OSHA, and any other regulatory requirements, the Abatement Contractor shall provide the following minimum respiratory protection to the maximum use concentrations indicated:

<u>MSHA/NIOSH Approved Respiratory Protection</u>	<u>Maximum Use Concentration</u>
Half-Mask Air Purifying with HEPA Filters	10x PEL
Full-Facepiece Air Purifying HEPA Filters and Quantitative Fit Test	10x PEL
Powered Air Purifying (PAPR), Loose fitting Helmet or Hood, HEPA Filter	25x PEL
Powered Air Purifying (PAPR), Full Facepiece, HEPA Filter	50x PEL
Supplied Air, Continuous Flow Loose fitting Helmet or Hood	25x PEL
Supplied Air, Continuous Flow Full Facepiece, HEPA Filter	50x PEL
Full Facepiece-Supplied Air Pressure Demand, HEPA Filter	100x PEL
Full Facepiece-Supplied Air Pressure Demand, with Aux. SCBA, Pressure Demand or Continuous Flow	>100x PEL

2. Disposable Clothing -"Tyvek" manufactured by Dupont or approved equal.
3. NIOSH approved safety goggles to protect eyes.
4. Polyethylene bags, 6 mil. (.006") thick (use double bags).

NOTE: Workers must wear disposable coveralls and respirator masks at all times while in the work area. Contaminated coveralls or equipment must be left in work area and not worn into other parts of the building.

### F. TOOLS AND EQUIPMENT

1. Airless Sprayer - An airless sprayer, suitable for application of encapsulating material, shall be used.
2. Scaffolding - Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.

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3. Transportation Equipment - Transportation equipment, as required, shall be suitable for loading, temporary storage, transport and unloading of contaminated waste without exposure to persons or property. Water tight, hard wall containers shall be provided to retain and dispose of any asbestos waste material with sharp-edged components that may tear plastic bags or sheeting. The containers shall be marked with danger labels.
4. Surfactant - Wetting Agents - "Asbestos-Wet" - Aquatrols Corp. of America or approved equal, and shall be non- carcinogenic.
5. Portable (negative air pressure) asbestos filtration system - by Micro-Trap, or approved equal.
6. Vacuum, HEPA type equal to "Nilfisk" #GA73, or "Pullman/Holt" #75 ASA.
7. Amended Water Sprayer - The water sprayer shall be an airless or other low-pressure sprayer for amended water application.
8. Other Tools and Equipment - The Abatement Contractor shall provide other suitable tools for the stripping, removal, encapsulation, and disposal activities including but not limited to: hand-held scrapers, nylon brushes, sponges, rounded edge shovels, brooms, and carts.

### **PART 3 – EXECUTION**

#### **3.01 PRE-ABATEMENT WORK AREA PREPARATION**

- A. The work area shall be vacated by the occupants prior to work area preparation and not reoccupied until satisfactory clearance air monitoring results have been achieved.
- B. Caution signs shall be posted at all locations and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted that permit a person to read the sign and take the necessary protective measures to avoid exposure.
- C. Shut down and lock out electric power to all work areas. The Abatement Contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment used where high humidity and/or water shall be sprayed in accordance with all applicable codes. All power to work areas shall be brought in from outside the area through a ground-fault interrupter at the source.
- D. Isolate the work area HVAC system.
- E. The personnel decontamination enclosure system shall be installed or constructed prior to preparatory work in the work area and in particular before the disturbance of asbestos material. The waste decontamination enclosure system shall be installed or constructed prior to commencement of abatement activities.
- F. Movable objects within the work area shall be pre-cleaned using HEPA filtered vacuum equipment an/or wet cleaning and such objects shall be removed from the work area to an uncontaminated location. If disposed of as asbestos waste material, cleaning is not required.
- G. Fixed objects and other items, which are to remain within the work area, shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Such objects shall be enclosed with two layers of at least six mil plastic sheeting and sealed with tape.

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- H. The work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters, shall be prohibited. Asbestos material shall not be disturbed during pre-cleaning.
- I. Isolation barriers that seal off all openings, including windows, corridors, doorways, ducts, and any other penetrations of the work area, shall be constructed using two layers of at least six mil fire-retardant plastic sheeting sealed with tape. Also, all seams in mechanical system components that pass through the work area shall be sealed. Doorways and corridors, which shall not be used for passage during work, shall also be sealed.
- J. Removal of mounted objects. After isolation barriers are in place, objects such as light fixtures, electrical track, alarm systems, ventilation equipment and other items not previously sealed, shall be double sealed with six mil fire-retardant plastic sheeting. Localized HEPA filtered vacuum equipment shall be used during fixture removal to reduce asbestos dispersal.
- K. Individual roof and floor drains shall be sealed watertight using two layers of 6-mil fire-retardant plastic sheeting and tape prior to plasticizing. Openings in floor shall be fully covered with plywood sheeting secured to the floor in such a way as to minimize a tripping hazard prior to plasticizing.
- L. Emergency and fire exits from the work area shall be maintained or alternate exits shall be established according to all applicable codes.
- M. Adequate toilet facilities shall be supplied by the Abatement Contractor and shall be located either in the clean area of the personnel decontamination enclosure or shall be readily accessible to the personnel decontamination enclosure.

### **3.02 LARGE ASBESTOS PROJECT PERSONNEL DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)**

- A. The personnel decontamination enclosure shall be constructed prior to preparatory work in the work area and in particular before the disturbance of asbestos material.
  - 1. Construction and use of personnel decontamination enclosure systems shall be in accordance with ICR-56 and any Applicable or Site Specific Variances utilized on this project. Such systems may consist of existing rooms outside of the work area, if the layout is appropriate, that can be enclosed is plastic sheeting and are accessible from the work area. When this situation does not exist, enclosure systems may be constructed out of metal, wood or plastic support.
  - 2. The personnel decontamination enclosure system shall consist of a clean room, a shower room, and an equipment room, in series, separated from each other and from the work area by three airlocks.
  - 3. There shall be one shower per six full shift abatement persons calculated on the basis of the largest shift.
  - 4. The personnel decontamination enclosure system shall be fully framed, sheathed for safety and constructed to prevent unauthorized entry.
  - 5. Personnel decontamination enclosure systems constructed at the work site shall utilize at least six mil fire-retardant opaque plastic sheeting. At least two layers of six mil fire-retardant reinforced plastic sheeting shall be used for the flooring of this area.
  - 6. All prefabricated decontamination units shall be completely decontaminated and sealed prior to separation and removal from the work area. Mobile decontamination units shall remain in place until satisfactory clearance results have been attained.

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7. The clean room shall be sized to accommodate all authorized persons. Benches, lockers and hooks shall be provided for street clothes. Shelves for storing respirators shall also be provided. Clean clothing, replacement filters for respirators, towels and other necessary items shall be provided. The clean room shall not be used for the storage of tools, equipment or materials. It shall not be used for office space. A lockable door shall be provided to permit access to the clean room from outside the work area or enclosure. It shall be used to secure the work area and decontamination enclosure during off-shift hours.
8. The shower room shall contain one or more showers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to ensure against leakage of any kind. Uncontaminated soap, shampoo and towels shall be available at all times. Shower water shall be drained, collected and filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste. The shower room shall be constructed in such way that travel through the decontamination unit shall be through the shower.
9. The equipment room shall be used for the storage of equipment and tools after decontamination using a HEPA filtered vacuum and/or wet cleaning. A one day supply of replacement filters, in sealed containers, for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers of surfactant and other materials and equipment that may be required during the abatement project may also be stored here. A walk-off pan filled with water shall be located in the work area just outside the equipment room for persons to clean foot covering when leaving the work area. A drum lined with a labeled, at least six mil plastic bag is required for collection of clothing and shall be located in this room. Contaminated footwear and work clothes shall be stored in this area.

### **3.03 WASTE DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)**

#### **A. General Requirements**

1. A waste decontamination enclosure system shall consist of the following:
  - a. A washroom/cleanup room shall be constructed with an airlock doorway to the work area and another airlock doorway to the holding area.
  - b. The holding area shall be constructed with an airlock doorway to the washroom/cleanup room and another lockable door to the outside.
2. Where there is only one egress from the work area, the holding area of the waste decontamination enclosure system may branch off from the equipment decontamination room, which doubles as a waste washroom, of the personnel decontamination enclosure.
3. The waste washroom shall be equipped with a drain installed to collect water and deliver it to the shower drain where it shall be filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste.
4. The waste washroom shall be constructed in such a way that travel through the rooms shall be through the waste washroom

**3.04 WORK AREA ENTRY AND EXIT PROCEDURES**

- A. The following procedures shall be followed throughout the asbestos abatement project until satisfactory clearance air monitoring results have been achieved:
1. All persons shall enter and exit the work area through the personnel decontamination enclosure system.
  2. All persons who enter the work area or an enclosure shall sign the entry/exit log, located in the clean room, upon every entry and exit.
  3. All persons, before entering the work area, or an enclosure shall read and be familiar with all posted regulations, personal protection requirements, including work area entry and exit procedures, and emergency procedures. The entry/exit log headings shall indicate, and the signatures shall be used to acknowledge, that these have been reviewed and understood by all persons prior to entry.
  4. All persons shall proceed first to the clean room, remove all street clothing, store these items in clean sealable plastic bags or lockers and don coveralls, head covering, foot covering and gloves. All persons shall also don NIOSH approved respiratory protection. Clean respirators and protective clothing shall be utilized, by each person, for each separate entry into the work area. Respirators shall be inspected prior to each use and tested for proper seal using quantitative or qualitative fit checks.
  5. Persons wearing designated personal protective equipment shall proceed from the clean room through the shower room to the equipment room, where necessary tools are collected and any additional clothing shall be donned, before entry into the work area.
  6. Before leaving the work area, all persons shall remove gross contamination from the outside of respirators and protective clothing by brushing, wet cleaning, and/or HEPA vacuuming.
  7. Persons shall proceed to the equipment room where all coveralls, head covering, foot covering and gloves shall be removed. Disposable clothing shall be deposited into labeled containers for disposal. Reusable contaminated clothing, footwear, head gear and gloves shall be stored in the equipment room when not being used in the work area.
  8. Still wearing respirators, persons shall proceed to the shower area, clean the outside of the respirator and the exposed face area under running water prior to removal of the respirator, and then fully and vigorously shower and shampoo to remove residual asbestos contamination. Respirators shall be washed thoroughly with soap and water. Some types of respirators will require slight modification of these procedures. An airline respirator with HEPA filtered disconnect protection shall be disconnected in the equipment room and worn into the shower. A powered air-purifying respirator facepiece shall be disconnected from the filter/power pack assembly prior to entering the shower.
  9. After showering and drying, all persons shall proceed to the clean room and don clean personal protective equipment if returning to the work area or street clothing if exiting the enclosure.

**3.05 EQUIPMENT AND WASTE CONTAINER DECONTAMINATION & REMOVAL PROCEDURES**

- A. The following procedures shall be followed throughout the asbestos abatement project until satisfactory clearance air monitoring results have been achieved.

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1. External surfaces of contaminated containers and equipment shall be cleaned by wet cleaning and/or HEPA vacuuming in the work area before moving such items into the waste decontamination enclosure system airlock by persons assigned to this duty. These work area persons shall not enter the airlock.
2. These contaminated items shall be removed from the airlock by persons stationed in the washroom during waste removal operations. These washroom persons shall remove gross contamination from the exterior of their respirators and protective clothing by brushing, HEPA vacuuming and/or wet cleaning.
3. Once in the waste decontamination enclosure system, external surfaces of contaminated containers and equipment shall be cleaned a second time by wet cleaning.
4. The cleaned containers of asbestos material and equipment are to be dried of any excessive pooled or beaded liquid, placed in uncontaminated plastic bags or sheeting and sealed airtight.
5. The clean recontainerized items shall be moved into the airlock that leads to the holding area. The washroom persons shall not enter this airlock or the work area until waste removal is finished for that period.
6. Containers and equipment shall be moved from the airlock and into the holding area by persons dressed in clean personal protective equipment, who have entered from uncontaminated areas.
7. The cleaned containers of asbestos material and equipment shall be placed in water tight carts with doors or tops that shall be closed and secured. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
8. The exit from the decontamination enclosure system shall be secured to prevent unauthorized entry.
9. Where the waste removal enclosure is part of the personnel decontamination enclosure, waste removal shall not occur during shift changes or when otherwise occupied. Precautions shall be taken to prevent short circuiting and cycling of air outward through the shower and clean room.
10. Containers labeled with Asbestos hazard warnings shall not be used to dispose of non asbestos waste.

### **3.06 ENGINEERING CONTROLS**

#### **A. Ventilation.**

1. The Abatement Contractor shall employ HEPA equipped vacuums or negative air pressure equipment for ventilation as required.
2. All negative air pressure equipment ventilation units shall be equipped with HEPA filtration. The Contractor shall provide a manufacturer's test certificate for each unit documenting the capability of trapping and retaining 99.97 percent of asbestos fibers greater than 0.3 microns equivalent aerodynamic diameter.
3. A power supply shall be available to satisfy the requirements of the total of all ventilating units.



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4. On electric power failure, abatement shall stop immediately and shall not resume until power is restored and exhaust units are operating fully. On extended power failure, longer than one hour, the decontamination facilities, after the evacuation of all persons from the work area, shall be sealed airtight.
5. If extending the exhaust of the ventilation units 50 feet from the building would result in an exhaust location either in the road, blocking driveway access to the facility or within 50 feet of other buildings, a second unit will be run in series with the primary unit.

### **3.07 MAINTENANCE OF DECONTAMINATION ENCLOSURE SYSTEMS AND WORK AREA BARRIERS**

#### **A. GENERAL REQUIREMENTS**

1. The Consultant must review and approve installation before commencement of work. Upon completion of the construction of all plastic barriers and decontamination system enclosures and prior to beginning actual abatement activities.
2. All plastic barriers inside the work area, in the personnel decontamination enclosure system, in the waste decontamination enclosure system and at partitions constructed to isolate the work area from occupied areas, shall be inspected by the asbestos supervisor at least twice daily. The barriers shall be inspected before the start of and following the completion of the day's abatement activities. Inspections and observations shall be documented in the project log.
3. Damage and defects in the barriers and/or enclosure systems shall be repaired immediately upon discovery and prior to resumption of abatement activities.
4. At any time during the abatement activities, if visible emissions are observed outside of the work area or if damage occurs to the barriers, work shall be stopped, repairs made and visible residue immediately cleaned up using HEPA vacuuming methods prior to the resumption of abatement activities.
5. The Abatement Contractor shall HEPA vacuum and/or wet clean the waste decontamination enclosure system and the personnel decontamination enclosure system at the end of each day of abatement activities.

### **3.08 HANDLING AND REMOVAL PROCEDURES**

The Abatement Contractor may utilize existing provisions of ICR-56, Applicable Variances or a Site Specific Variance, approved by the Owner's Consultant, to permit the conduct of this work.

### **3.09 ABATEMENT PROCEDURES**

#### **A. AIR SAMPLING - By Owner**

1. Air sampling and analysis shall be conducted according to the requirements of Subpart 56-4 before the start, during and after the completion of the asbestos removal project.
2. In addition to the requirements of Subpart 56-4, air monitoring shall be conducted in accordance with any approved job specific variance(s) or applicable variance utilized.
3. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
4. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR 763.90[i].

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- B. The provisions of the Applicable Variances or a Job Specific Variance shall apply only in those areas where approval has been granted by the NYS DOL and the Contractor has obtained concurrence from the Owner's Consultant. All other applicable provisions of Industrial Code Rule 56-1 through 56-12 shall be complied.
- C. A copy of the NYS DOL Job Specific or Applicable Variance, if applicable, shall be conspicuously posted at the work area(s).
- D. The Abatement Contractor shall construct a decontamination unit at the work site. The Abatement Contractor shall, as a minimum, comply with the requirements of 29 CFR 1926.1101(j); Hygiene facilities and practices for employees.

### 3.10 ENCAPSULATION PROCEDURES

The following procedures shall be followed to seal in non-visible residue, after obtaining satisfactory clearance air monitoring results, while conducting lockdown encapsulation on any surfaces which were the subject of removal or other remediation activities:

- A. Only encapsulants rated as acceptable or marginally acceptable on the basis of Battelle Columbus Laboratory test procedures and rating requirements developed under the 1978 USEPA contract shall be used for lockdown encapsulation.
- B. Sealants considered for use in encapsulation shall first be tested to ensure that the sealant is adequate for its intended use. A section of the work surface shall be evaluated following this initial test application of the sealant to quantitatively determine the sealant's effectiveness in terms of penetrating and locking down the asbestos fibers. The American Society of Testing and Materials (ASTM) Committee E06.21.06E on Encapsulation of Building Materials has developed a guidance document to assist in the selection of an encapsulant.
- C. The encapsulant solvent or vehicle shall not contain a volatile hydrocarbon.
- D. Encapsulants shall be applied using airless spray equipment.
  - 1. Spraying is to occur at the lowest pressure range possible to minimize fiber release from encapsulant impact at the surface. It shall be applied with a consistent horizontal or vertical motion.
- E. Encapsulation shall be utilized as a surface sealant once all asbestos containing materials have been removed in a work area. In no event shall encapsulant be applied to any surface that was the subject of removal or other remediation activities prior to obtaining satisfactory clearance air monitoring.

### 3.11 CLEANUP PROCEDURES

- A. The following cleanup procedures shall be required.
  - 1. Cleanup of accumulations of loose asbestos material shall be performed whenever enough loose asbestos materials have been removed to fill a single leak tight container of the type commensurate with the material properties. In no case shall cleanup be performed less than once prior to the close of each working day. Asbestos material shall be kept wet until cleaned up.
  - 2. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum cleaning methods.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

3. Decontamination enclosures shall be HEPA vacuumed at the end of each shift.
4. Accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pans, squeegees or shovels. Metal shovels shall not be used to pick up or move waste.
5. Excessive water accumulation or flooding in the area shall require work to stop until the water is collected and disposed of properly.

B. The following cleanup procedures shall be required after completion of all removal activities.

1. All accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pan, squeegees or shovels. Metal shovels shall not be used to pick up or move waste. HEPA vacuums shall be used to clean all surfaces after gross cleanup.
2. Cleaning. All surfaces in the work area shall be HEPA vacuumed. To pick up excess liquid and wet debris, a wet purpose shop vacuum may be used and shall be decontaminated prior to removal from the work area.
3. Windows, doors, HVAC system vents and all other openings shall remain sealed. Decontamination enclosure systems shall remain in place and be utilized.
4. All containerized waste shall be removed from the work area and the holding area.
5. All tools and equipment shall be decontaminated and removed from the work area.
6. A final visual inspection and clearance air monitoring, as per the schedule for air sampling and analysis, shall be conducted.
7. The isolation barriers and decontamination unit shall be removed only after satisfactory clearance air monitoring results have been achieved.

### 3.12 SAFETY MONITORING – CONSULTANT:

The Consultant will designate an Asbestos Safety Technician (AST) to represent the Owner during the removal program. The AST must be on the job site at all times during abatement work. Absolutely no abatement or preparation work will occur without the presence of the AST.

The AST will conduct four (4) milestone inspections.

1. Pre-commencement inspection shall be conducted as follows:
  - a. Notification in writing to the Consultant shall be made by the Abatement Contractor to request a pre-commencement inspection at least 48 hours in advance of the desired date of inspection. This inspection shall be requested prior to beginning preparatory work in another work area.
  - b. The AST shall ensure that:
    - i. The job site is properly prepared and that all containment measures are in place;
    - ii. The designated supervisor shall present to the inspector a valid supervisor's license issued by the New York Department of Labor;
    - iii. All workers shall present to the inspector a valid handler's license issued by the New York Department of Labor;

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- iv. Measures for the disposal of removed asbestos material are in place and shall conform to the adopted standards;
- v. The Abatement Contractor has a list of emergency telephone numbers at the job site which shall include the monitoring firm employed by the Owner and telephone numbers for fire, police, emergency squad, local hospital and health officer.
- c. If all is in order, the AST shall issue a written notice to proceed in the field. If the job site is not in order, then any needed corrective action must be taken before any work is to commence. Conditional approvals shall not be granted.

Progress inspection shall be conducted as follows:

- a. Primary responsibility for ensuring that the abatement work progresses in accordance with these technical specifications and regulatory requirements rests with the Abatement Contractor. The AST shall continuously be present to observe the progress of work and perform required tests.
- b. If the AST observes irregularities at any time, he shall direct such corrective action as may be necessary. If the Abatement Contractor fails to take the corrective action required, or if the Abatement Contractor or any of their employees habitually and/or excessively violate the requirements of any regulation, then the AST shall inform the Owner who shall issue a Stop Work Order to the Abatement Contractor and have the work site secured until all violations are abated.

Clean-up inspections shall be conducted as follows:

- a. Notice for clean-up inspection shall be requested by the Abatement Contractor at least 24 hours in advance of the desired date of inspection;
  - b. The clean-up inspection shall be conducted prior to the removal of any isolation or critical barriers and before final air clearance monitoring;
  - c. The AST shall ensure that:
    - i. The work site has been properly cleaned and is free of visible asbestos containing material and debris.
    - ii. All removed asbestos has been properly placed in a locked secure container outside of the work area.
  - d. If all is in order, the AST shall issue a written notice of authorization to remove surface barriers from the work area. All isolation barriers shall remain in place until satisfactory clearance air sampling has been completed.
4. Clearance Visual Inspection shall be conducted after the removal of non-critical plastic sheeting. The AST shall insure that:
- a. The work area is free of all visible asbestos or suspect asbestos debris and residue.
  - b. All waste has been properly bagged and removed from the work area.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- c. Should clearance visual inspection identify residual debris, as determined by the AST, the Abatement Contractor is responsible for recleaning the area at his own cost and shall bear all costs of reinspection until acceptable levels are achieved.
- B. The Abatement Contractor shall be required to receive written approval before proceeding after each milestone inspection.

### **3.13 PERSONNEL AIR MONITORING – CONTRACTOR (29 CFR 1926.1101)**

- A. Personnel air monitoring shall be provided to determine both short-term (STEL) and full shift during when abatement activities occur. Personnel sampling shall be performed in each work area in order to accurately determine the concentrations of airborne asbestos to which workers may be exposed.
- B. The Abatement Contractor shall have a qualified "Competent Person" (as specified in 29 CFR 1926 OSHA) to conduct personnel air monitoring.
- C. The laboratory performing the air sample analysis shall be certified by NYS DOH ELAP and approved by the consultant.
- D. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.

### **3.14 CLEARANCE AIR MONITORING**

- A. Air samples will be collected in and around the work areas at the completion of abatement activities.
- B. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
- C. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR part 763 "Asbestos-Containing Materials in Schools; Final Rule and Notice" section 763.90.
- D. \*\*\*RETESTING\*\*\*  
Should clearance air monitoring yield fiber concentrations above the "Clearance" criteria of either 0.01 fibers per CC and/or background levels (PCM) –OR- seventy (70) structures per square millimeter (TEM/AHERA), the Abatement Contractor is responsible for re-cleaning the area at his own cost and shall bear all costs associated with the retesting of the work area(s) including monitoring labor, sampling, analysis, etc. until such levels are achieved.

### **3.15 RESPIRATORY PROTECTION REQUIREMENT**

- A. Respiratory protection shall be worn by all individuals inside the work area from the initiation of the asbestos project until all areas have successfully passed clearance air monitoring in accordance with these specifications. The Abatement Contractor shall keep available at all times two PAPR's with new filters and charged batteries for use by authorized visitors.
- B. All respiratory protection shall be MSHA/NIOSH approved in accordance with the provisions of 30 CFR Part II. All respiratory protection shall be provided by the Abatement Contractor, and used by workers in conjunction with the written respiratory protection program.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- C. The Abatement Contractor shall provide respirators that meet the requirements of 29 CFR Parts 1910 and 1926.
1. Full facepiece Type C supplied-air respirators operated in pressure demand mode equipped with an auxiliary self-contained breathing apparatus, operated in pressure demand or continuous flow, shall be worn during gross removal, demolition, renovation and/or other disturbance of ACM whenever airborne fiber concentrations inside the work area are greater than 10.0 f/cc.
  2. Full facepiece Type C supplied-air respirators operated in pressure demand mode with HEPA filter disconnect protection shall be work during gross removal, demolition, renovation and/or other disturbance of ACM with an amphibole content and/or whenever airborne fiber concentrations inside the work area are equal to or greater than 0.5 f/cc and less than or equal to 10.0 f/cc.
  3. Full facepiece powered air-purifying respirators (PAPR) equipped with HEPA filters shall be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.5 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow, with HEPA filter disconnect protection, may be substituted for a powered air-purifying respirator.
  4. Loose fitting helmets or hoods with powered air-purifying respirators (PAPR) equipped with HEPA filters may be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.25 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow may be substituted for a powered air-purifying respirator.
  5. Half-mask or full-face air-purifying respirators with HEPA filters shall be worn only during the preparation of the work area and final clean up procedures provided airborne fiber concentrations inside the work area are less than 0.1 f/cc.
  6. Use of single use dust respirators is prohibited for the above respiratory protection.
- D. Workers shall be provided with personally issued and individually marked respirators. Respirators shall not be marked with any equipment that will alter the fit of the respirator in any way. Only waterproof identification markers shall be used.
- E. The Abatement Contractor shall ensure that the workers are qualitatively or quantitatively fit tested by an Industrial Hygienist initially and every six months thereafter with the type of respirator he/she will be using.
- F. Whenever the respirator design permits, workers shall perform the positive and negative air pressure fit test each time a respirator is worn. Powered air-purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- G. No facial hair, which interferes with the face-to-mask sealing surface, shall be permitted to be worn when wearing respiratory protection that requires a mask-to-face seal.
- H. Contact lenses shall not be worn in conjunction with respiratory protection.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- I. If a worker wears glasses, a spectacle kit to fit their respirator shall be provided by the Abatement Contractor at the Abatement Contractor's expense.
- J. Respiratory protection maintenance and decontamination procedures shall meet the following requirement:
  - 1. Respiratory protection shall be inspected and decontaminated on a daily basis in accordance with OSHA 29 CFR 1910.134(b); and
  - 2. HEPA filters for negative pressure respirators shall be changed after each shower; and
  - 3. Respiratory protection shall be the last piece of worker protection equipment to be removed. Workers must wear respirators in the shower when going through decontamination procedures; and
  - 4. Airline respirators with HEPA filtered disconnect shall be disconnected in the equipment room and worn into the shower. Powered air-purifying respirator facepieces shall be worn into the shower. Filtered/power pack assemblies shall be decontaminated in accordance with manufacturers' recommendations; and
  - 5. Respirators shall be stored in a dry place and in such a manner that the facepiece and exhalation valves are not distorted; and
  - 6. Organic solvents shall not be used for washing of respirators.
- K. No visitors shall be allowed to enter the contaminated area if they do not have their medical certification and training certificate. Authorized visitors shall be provided with suitable PAPR respirators and instructions on the proper use of respirators whenever entering the work area.

### 3.16 DISPOSAL OF WASTE

#### A. APPLICABLE REGULATIONS

- 1. All asbestos waste shall be stored, transported and disposed of as per, but not limited to, the following Regulations:
  - a. NYS Code Rule 56
  - b. U.S. Department of Transportation (DOT)  
Hazardous Substances  
Title 29, Part 171 and 172 of the code of Federal Regulations  
regarding waste collector registration
  - c. Regulations regarding waste collector registration Title 6, part 364 of the New York State Official Compilation of Codes, Rules and Regulations – 6 NYCRR 364
  - d. USEPA NESHAPS 40 CRF 61
  - e. USEPA ASBESTOS WASTE MANAGEMENT GUIDANCE EPA/530-SW-85-007

- B. TRANSPORTER OR HAULER - The Abatement Contractor shall bear full responsibility for proper characterization, transportation and disposal of all solid or liquid waste, generated during the project, in a legal manner. The Owner shall approve all transportation and disposal methods.



## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

1. The Abatement Contractor's Transporter (hauler) and disposal site shall be approved by the Owner. The Abatement Contractor shall remove within 48 hours all asbestos waste from the site after completing the clean up.
2. The Transporter must possess and present to the Owner's representative a valid New York State Department of Environmental Conservation Part 364 asbestos hauler's permit to verify license plate and permit numbers. The Owner's representative will verify the authenticity of the hauler's permit with the proper authority.
3. The Abatement Contractor shall give 24 hour notification prior to removing any waste from the site. All waste shall be removed from site only during normal working hours. No waste may be taken from the site without authorization from the Owner's representative.
4. The Abatement Contractor shall have the Transporter give the date and time of arrival at the disposal site.
5. The Transporter with the Abatement Contractor and Owner's consultant shall inspect all material in the transport container prior to taking possession and signing the Waste Manifest. The Transporter shall not have any off site transfers or be combined with any other off-site asbestos material.
6. The Transporter must travel directly to the disposal site with no unauthorized stops.

### C. WASTE STORAGE CONTAINER

1. During loading and on site storage, the asbestos waste container shall be labeled with EPA Danger signage:

**DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE HAZARD**

2. The NYS DEC Hauler's Permit number shall be on both sides and back of the container.
3. The Container will not be permitted to leave the site without the proper signage.
4. A copy of the completed waste manifest shall be forwarded directly to the Owner's Consultant by the disposal facility.
5. Packaging of Non-friable Asbestos. Use of an open top container shall require written request, by the Contractor, and written approval by the Owners Representative, and be performed in compliance with all applicable regulations.
  - a) A chute, if used, shall be air/dust tight along its lateral perimeter and at the terminal connection to the dumpster at ground level (solid wall and top container). The upper end of the chute shall be furnished with a hinged lid, to be closed when the chute is not being used.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

- b) The container shall be lined with a minimum of two (2) layers of 6 mil. Fire-retardant polyethylene draped loosely over the sides so as to facilitate being wrapped over the top of the load and sealed prior to transport from the site.
  - c) Prior to transport from the work site the Dumpster will be disconnected from the chute and sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.
6. Packaging Friable Asbestos.
- a) The container shall be a solid wall, hard top and lockable container.
  - b) The container shall be locked upon arrival at the site to restrict access. Security shall be provided at the entrance to the container during the loading process and immediately locked upon completion.
  - c) The interior walls, floor and ceiling shall be lined with two (2) layers of 6 mil. Fire-retardant polyethylene.
  - d) The waste shall be loaded in such a manner as to protect the integrity of the individual waste packages.
  - e) Prior to transport from the work site the interior of the Dumpster will sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.

### D. WASTE DISPOSAL MANIFEST

- 1. The Asbestos Waste Manifest shall be equivalent to the "Waste Shipment Record" included in 40 CFR 61. A copy of the Contractor's manifest shall be reviewed by the Owner's Consultant and shall be the only manifest used.
- 2. The Manifest shall be verified by the Owner's Consultant indicating that all the information and amounts are accurate and the proper signatures are in place.
- 3. The Manifest shall have the signatures of the Abatement Contractor and the Transporter prior to any waste being removed from the site.
- 4. The Manifest shall be signed by the Disposal Facility owner or operator to certify receipt of asbestos containing materials covered by the manifest.
- 5. A copy of the completed manifest shall be provided by the Abatement Contractor to the Owner's Consultant and remain on site for inspection.
- 6. Abatement Contractor shall maintain a waste disposal log which indicates load number, date and time left site, container size, type of waste, quantity of waste, name of hauler, NYS DES permit number, trailer and tractor license number, and date manifest was returned to Consultant.

SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

7. The Disposal Facility owner or operator shall return a signed copy of the Waste Manifest directly to:

**Mamaroneck UFSD  
1000 W. Boston Post Road  
Mamaroneck, New York 10543  
ATTN: Steve Brugge**

8. Copies of the completed Waste Manifest are to be sent by the disposal facility to the Hauler and Abatement Contractor.
9. Submit signed dump tickets and manifests with final payment request.
10. Final payment request will not be honored without signed dump ticket or manifests accounting for all asbestos waste removed from the site.

**E. VIOLATIONS OF SPECIFICATIONS**

1. Violations of the safety, hygiene, environmental, procedures herein, any applicable federal, state or local requirements or failure to cooperate with the Owner's representative shall be grounds for dismissal and/or termination of this contract.

**F. VIOLATIONS OF NO SMOKING POLICY**

1. The Federal Pro Children Act of 1994 prohibits School District Officials from smoking in any buildings or on the grounds that is property of the School District. The District shall be considered smoke free. The School District strongly enforces its' No Smoking Policy. It is the Contractor's responsibility to inform all workers of this policy. Any worker(s) involved with this project that are found smoking or using tobacco products will be informed that they are in violation of the Federal and State Law and School Board Policy and will be removed from site.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 3.17 LOCATION OF WORK – BASE BID

*(Please see attached Drawings for approximate locations)*

#### 1) Chatsworth Elementary School (Interiors) – 1<sup>st</sup> Floor Hallway (pipe)

- Asbestos Abatement Contractor responsible for total and complete removal and disposal of approximately 2,000 LF of friable asbestos-containing Mudded Pipe Joints/ Elbows/ Fittings/ Etc. & ACM Pipe Insulation above Non-ACM Plaster Ceilings. Throughout the first-floor hallway, 56-11.8 Wrap & Cut (will be allowed if contractor decides this is the best means and methods), Pipes to be marked by the plumbing contractor prior to removal, as detailed on attached ACM Location Drawings. Asbestos Abatement Contractor to perform removals utilizing manual, wet methods to ensure total and complete removal of entire existing Domestic Plumbing Pipes, including all associated plaster layers/metal mesh/wooden lathe, etc. to building substrate(s) to gain access. Any and all existing black iron systems shall not remain intact. Asbestos Abatement Contractor responsible for performing all demolition activities required to access materials, as well as for providing all labor, equipment and materials necessary. Re-installation(s) and/or patching of non-asbestos wall coverings/finishes and plumbing pipes shall be the responsibility of the General Contractor and the plumbing contractor.

#### 2) Chatsworth Elementary School (Interiors) – Classroom 309 and Closet in Classroom 309

- Asbestos Abatement Contractor responsible for total and complete removal and disposal of approximately 400 SF of non-friable asbestos-containing Floor Tiles and non-asbestos Mastics/Levelers/Fillers/Etc. throughout, as detailed on attached ACM Location Drawings. Removals shall include all flooring system layers to building substrate(s) beneath, consisting of ACM Floor Tiles, Mastics, Levelers/Fillers, Flash Patches, Etc. over Non-ACM Cementitious Slab(s). Asbestos Abatement Contractor responsible for performing all demolition activities required to access materials, as well as for providing all labor, equipment and materials necessary. Subsequent to final air clearance, the substrates shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering(s) and eliminate residual odors. Re-installation(s) and/or patching of non-asbestos floor coverings/finishes shall be the responsibility of the General Contractor.

**END OF LOCATION OF WORK**

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### 3.18 GENERAL

- A. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to: ceiling tiles, ceiling finishes, wall finishes, floor finishes, etc.
- B. The Abatement Contractor shall be responsible for all demolition required to access materials identified in scope of work and on associated drawings.
- C. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. Additional asbestos abatement performed prior to the order to proceed will not be acknowledged.
- D. The Abatement Contractor shall remove asbestos-containing floor covering to the building substrate beneath; in areas indicted. Subsequent to final air clearance the substrate shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
- E. Power tools used to drill, cut into or otherwise disturb asbestos containing material shall be equipped with HEPA filtered local exhaust ventilation.
- F. The Abatement Contractor shall provide access to GFCI electrical power, required to perform the area air monitoring for this project, within and immediately adjacent to each work area.
- G. Unwrapped or unbagged ACM shall be immediately placed in an impermeable waste bag or wrapped in plastic sheeting.
- H. Coordinate all removal operations with the Owner.

.....

**RETURN THIS EXECUTED FORM WITH COMPLETED BID SHEET**

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**Asbestos Employee Medical Examination Statement  
Certificate of Worker Release  
Asbestos Employee Training Statement  
CERTIFICATE OF WORKERS'S ACKNOWLEDGEMENT**

PROJECT NAME: **Mamaroneck UFSD/2019 Bond Referendum  
Capital Improvements at Chatsworth Avenue School**

ABATEMENT CONTRACTOR'S NAME: \_\_\_\_\_

**WORKING WITH ASBESTOS INVOLVES POTENTIAL EXPOSURE TO AIRBORNE ASBESTOS FIBERS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER AND RESPIRATORY DISEASES. SMOKING CIGARETTES AND INHALATION OF ASBESTOS FIBERS INCREASES THE RISK THAT YOU WILL DEVELOP LUNG CANCER ABOVE THAT OF THE NON-SMOKING PUBLIC.**

The Contract for this project requires the Abatement Contracting Company to: 1) supply proper respiratory protection devices, and training on their use, to their employees; 2) provide training on safe work practices, and on use of the equipment used on the project, to their employees; and, 3) provide annual medical examinations to their employees meeting the requirements of 29 CFR 1926.1101. The Abatement Contracting Company's signature on this certificate, documents that these contractual obligations are fulfilled, and that you understand the information presented to you.

**\*\*\*\*\*DO NOT SIGN THIS FORM UNLESS YOU FULLY UNDERSTAND THIS INFORMATION\*\*\*\*\***

RESPIRATORY PROTECTION: I have been trained in the proper use and limitations of the type of respiratory protection devices to be used on this project. I have reviewed the written respiratory protection program manual and a copy is available for my use. Respiratory protection equipment has been proved, by the Contractor, at no cost to me.

TRAINING COURSE: I have been trained in the risks and dangers associated with handling asbestos, breathing asbestos dust, proper work procedures, personal protection and engineering controls. I have satisfactorily completed and Asbestos Safety Training Program for New York State and have been issued a New York State Department of Health Certificate of Asbestos Safety Training.

MEDICAL EXAMINATION: I have satisfactorily completed a medical examination within the last 12 months that meets the OSHA requirement for an asbestos worker and included at least 1) medical history 2) pulmonary function 3) medical examination 4) approval to wear respiratory protection devises and may have included an evaluation of a chest x-ray.

Signature: \_\_\_\_\_ Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_

Witness Signature: \_\_\_\_\_ Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_

.....

**RETURN THIS EXECUTED FORM WITH COMPLETED BID SHEET**

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**RETURN THIS EXECUTED FORM WITH COMPLETED BID SHEET**

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**ESTIMATE OF ACM QUANTITIES**

PROJECT NAME: **Mamaroneck UFSD/2019 Bond Referendum**  
**Capital Improvements at Chatsworth Avenue School**

\*\*\*\*\*

**EACH ABATEMENT CONTRACTOR SHALL READ AND ACKNOWLEDGE THE FOLLOWING NOTICE. A SIGNED AND DATED COPY OF THIS ACKNOWLEDGMENT SHALL BE SUBMITTED WITH THE ABATEMENT CONTRACTOR'S BID FOR THIS PROJECT. FAILURE TO DO SO MAY, AT THE SOLE DISCRETION OF THE OWNER, RESULT IN THE BID BEING CONSIDERED NON-RESPONSIVE AND RESULT IN DISQUALIFICATION OF THE ABATEMENT CONTRACTOR'S BID ON THIS PROJECT.**

\*\*\*\*\*

**\*\*\* NOTICE \*\*\***

***The linear and square footages listed within this specification are approximates. Abatement Contractor is required to visit the work locations prior to bid submittal in order to take actual field measurements within each listed location. The Abatement Contractor shall base their bid on actual quantities determined, by them, at the site walkthrough. Estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project.***

\*\*\*\*\*

**Acknowledgment:** I have read and understand the above **NOTICE** regarding removal quantity estimates and understand that estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project. The Abatement Contractor's signatory represents to the Owner that he/she has the authority of the entity he/she represents to sign this agreement on its behalf.

Company Name: \_\_\_\_\_  
Type or Print

BY: \_\_\_\_\_  
Signature Title Date

Print Name: \_\_\_\_\_

.....

**RETURN THIS EXECUTED FORM WITH COMPLETED BID SHEET**

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SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

**ASSOCIATED ASBESTOS REMOVAL LOCATION DRAWINGS**

- **Mamaroneck UFSD: Mamaroneck UFSD/2019 Bond Referendum  
Capital Improvements at Chatsworth Avenue School**
  - DRAWING #H1.02 – Existing Third Floor**
  - DRAWING # HP 1.01 – Existing First Floor Abatement Plan**

**END OF SPECIFICATION  
SECTION 02080**



## SECTION 030505 – UNDER-SLAB VAPOR BARRIER

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. Products supplied under this section:
  - 1. Vapor barrier and installation accessories for installation under concrete slabs.
- B. Related sections:
  - 1. Section 03 30 00 Cast-in-Place Concrete
  - 2. Section 07 27 26 Air Barriers

#### 1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
  - 2. ASTM E1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
  - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
  - 2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

#### 1.3 SUBMITTALS

- A. Quality control/assurance:
  - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
  - 2. Manufacturer's samples and literature.
  - 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
  - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Vapor barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft<sup>2</sup> · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
  2. Other performance criteria:
    - a. Strength: ASTM E1745 Class A.
    - b. Thickness: 15 mils minimum
  3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  2. No substitutions.

## 2.2 ACCESSORIES

- A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  2. Stego Tape by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- C. Perimeter/edge
1. Stego Crete Claw by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- D. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- E. Vapor Barrier-Safe Screed System
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).

## PART 3 – EXECUTION

### 3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

### 3.2 INSTALLATION

#### A. Install vapor barrier in accordance ASTM E1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.

[Specifier note: The perimeter seal can be handled several ways. When sealing to the slab,

Crete Claw is the best option. When sealing to a stem wall or wall,

the best option is to use StegoTack Tape or both StegoTack Tape and Stego Term Bar.]

- a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
  - OR
  - b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
3. Overlap joints 6 inches and seal with manufacturer's seam tape.
4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier
7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION 030505



## SECTION 031513 – WATERSTOPS FOR CONCRETE JOINTS

### PART 1 - GENERAL

#### 1.01 Provision Includes

- A. Embedded waterstop in concrete including contraction, expansion and construction joints creating a continuous diaphragm to prevent the passage of fluid.
- B. The use of nonmetallic waterstops for use in concrete joints subjected to chlorinated water, sea water, oils, solvents, acids, salts, fuels and many other aggressive chemicals and fluids.

#### 1.02 References

##### A. American Society for Testing and Materials (ASTM)

- 1. ASTM D 395 — Test Methods for Rubber Property – Compression Set.
- 2. ASTM D 412 — Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension.
- 3. ASTM D 471 — Test Method for Rubber Properties – Effects of Chemicals.
- 4. ASTM D 624 — Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- 5. ASTM D 746 — Test Method for Brittleness Temperature of Plastics by Impact.
- 6. ASTM D 792 — Test Method for Specific Gravity (Gravity Density) and Density of Plastics by Displacement.
- 7. ASTM D 1171 — Test Method for Ozone Resistance at 500 pphm.
- 8. ASTM D 2240 — Test Method for Shore Hardness.

##### B. Federal Specifications

- 1. COE CEGS-03250 July 1995 Guide Specification for Military Construction.
- 2. EPA Title 40 CFR Section 265.193.

##### C. American Concrete Institute

- 1. ACI 350.2R-04 — Concrete Structures for Containment of Hazardous Wastes.

##### D. NSF International

- 1. NSF/ANSI Standard 61 Certification for Drinking Water System Components — Health Effects.

##### E. BuildingGreen, Inc.

- 1. GreenSpec® — GreenSpec® Directory, 6<sup>th</sup> Edition.

#### 1.03 Submittal Procedures

##### A. Chemical Resistant Waterstops

- 1. Earth Shield TPV Waterstop submittal shall contain the following:
  - a. Samples of each size and shape to be used.
  - b. Plate drawings of the waterstop profile indicating all dimensions.
  - c. Shop drawings of shop made fittings to be provided by the manufacturer or prepared by the contractor.



- d. Copy of test results of ASTM D 471 Chemical Resistance showing compliance with Appendix A.
  - e. Copy of independent certification to NSF/ANSI Standard 61 Certification for Drinking Water System Components — Health Effects.
  - f. Copy of independent testing to ASTM D 1171 Ozone Resistance to 500 pphm concentration.
  - g. Manufacturer's Literature, including MSDS sheets, installation instructions and splicing instructions.
  - h. Certificate of compliance to physical properties outlined in this specification.
2. Non-metallic Waterstop and Splices — Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 6 inches long of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the shop and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

#### 1.04 Delivery and Storage

- A. Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants.

## PART 2 - PRODUCTS

### 2.01 Waterstops

- A. Intersection and change of direction waterstops shall be shop fabricated.
- B. Manufacturer:
  1. JP Specialties, Inc.
  2. Hohmann & Bernard, Inc.
  3. Henry
  4. Or approved equal.
- C. Non-Metallic Waterstops — Non-metallic waterstops shall be manufactured from a fully cross-linked thermoplastic vulcanizate, containing no scrap or reclaimed material.
  1. Thermoplastic Vulcanizate (TPV) Waterstop shall conform to EPA Title 40 CFR Section 265.193. The suitability of the waterstop for a specific application should be determined by specific testing for that particular requirement by ASTM D 471.
  2. Thermoplastic Vulcanizate (TPV) Waterstop shall be certified for use in potable water per NSF/ANSI Standard 61. Third-party certified documentation to be provided by manufacturer.

**Thermoplastic Vulcanizate (TPV) Waterstop shall conform to the following typical physical properties:**

Property	Test Method	Required Results
Specific Gravity	ASTM D 792	.96
Shore A Hardness (5 sec.)	ASTM D 2240	90±3 at 77°F
Tensile Strength	ASTM D 412	2,300 psi
Ultimate Elongation	ASTM D 412	530%
100% Modulus	ASTM D 746	1,000 psi
Tear Strength	ASTM D 624	278 pli at 77°F

Property	Test Method	Required Results
Compression Set	ASTM D 395	29% at 77°F
Brittle Point	ASTM D 746	-78°F
Drinking Water Safe	NSF/ANSI 61	Certified for use in potable water ( <i>see Appendix B</i> ).
Ozone Resistance	ASTM D 1171	Passed, no cracking at 500 pphm
Chemical Resistance	ASTM D 471	Meet or exceed specific testing standards for contained fluids as required by Owner and <i>certified</i> by Manufacturer.
Green Certification	GreenSpec	Approved

Unless otherwise specified or indicated on the drawings provide the following types or approved equal:

1. **Part No. JP436** — 4" x 3/16" ribbed centerbulb, as manufactured by **JP Specialties, Inc.** (*all-purpose waterstop; if specified with factory installed brass eyelets use part no. EYJP436*) (NSF)
2. **Part No. JP636** — 6" x 3/16" ribbed centerbulb, as manufactured by **JP Specialties, Inc.** (*all-purpose waterstop; if specified with factory installed brass eyelets use part no. EYJP636*) (NSF)
3. **Part No. JP936** — 9" x 3/16" ribbed centerbulb, as manufactured **JP Specialties, Inc.** (*all-purpose waterstop; if specified with factory installed brass eyelets use part no. EYJP936*) (NSF)
4. **Part No. JP678** — 6" x 3/16" ribbed tear web, as manufactured by **JP Specialties, Inc.** (*for extreme joint movement; if specified with factory installed brass eyelets use part no. EYJP678*) (NSF)
5. **Part No. JP978** — 9" x 3/16" ribbed tear web, as manufactured by **JP Specialties, Inc.** (*for extreme joint movement; if specified with factory installed brass eyelets use part no. EYJP978*) (NSF)
6. **Part No. JP211** — 9" x 3/16" base seal, as manufactured by **JP Specialties, Inc.** (*for runway and pavement applications*) (NSF)
7. **Part No. JP320L** — 3" x 3/16" tear web retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP320L*) (NSF)
8. **Part No. JP325T** — 3" x 3/16" T-shaped retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP325T*) (NSF)
9. **Part No. JP336L** — 3" x 3/16" retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP336L*) (NSF)
10. **Part No. JP621L** — 4-1/2" x 3/16" large movement retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; large shear movements*) (NSF)
11. **Part No. JP450T** — 5" x 3/16" T-shaped retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP450T*) (NSF)
12. **Part No. JP647** — 6" x 1/4" dumbbell, as manufactured by **JP Specialties, Inc.** (*for construction joints*) (NSF)
13. **Part No. JP648** — 6" x 3/8" dumbbell, as manufactured by **JP Specialties, Inc.** (*especially designed for Carollo Engineers [construction joints]*) (NSF)
14. **Part No. JP948** — 9" x 3/8" dumbbell, as manufactured by **JP Specialties, Inc.** (*for construction joints*) (NSF)
15. **Part No. JP949** — 9" x 3/8" dumbbell centerbulb, as manufactured by **JP Specialties, Inc.** (*especially designed for Carollo Engineers [expansion joints]*) (NSF)

16. **Part No. JP1149** — 12" x 3/8" dumbbell centerbulb, as manufactured by **JP Specialties, Inc.** (*especially designed for Carollo Engineers [expansion joints]*) <sup>NSF</sup>
17. **Part No. JP158** — 1" screed key cap, as manufactured by **JP Specialties, Inc.** (*designed for keyed joints*) <sup>NSF</sup>
18. **Part No. JPEB350** — 1/2" integrated cap seal waterstop, as manufactured by **JP Specialties, Inc.** (*designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB350*)
19. **Part No. JPEB375** — 3/4" integrated cap seal waterstop, as manufactured by **JP Specialties, Inc.** (*designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB375*)
20. **Part No. JPEB375R** — 3/4" integrated cap seal retrofit waterstop, as manufactured by **JP Specialties, Inc.** (*designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB375R*)

### PART 3 - EXECUTION

#### 3.01 Waterstop, Installations and Splices

- A. Waterstops shall be installed at the locations shown to form a continuous fluid-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced.
- B. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified, trained personnel using approved equipment and procedures.
- C. Non-Metallic Shop Made Fittings — Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependent), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined and using an ST-10<sup>®</sup> waterstop splicing tool. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.
- D. Thermoplastic Vulcanizate Waterstop — The splicing of straight lengths shall be done by squaring the ends to be joined and using an ST-10<sup>®</sup> waterstop splicing tool utilizing a thermoplastic splicing iron with a non-stick surface specifically designed for waterstop welding. The correct temperature (410°F to 430°F) shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

#### 3.02 Preparation

- A. Uncoil waterstop 24 hours prior to installation for ease of handling and fabrication.
- B. Position waterstop to ensure proper distance from steel reinforcing bars to prevent rock pockets and honeycomb (see installation section 3.04).
- C. Protect waterstop from damage during progress of work.
- D. Clean concrete joint after first pour to remove debris and dirt.

#### 3.03 Examination/Inspection

- A. Prior to placement of concrete notify engineer for field inspection approval.
- B. Inspect waterstop and field splices for defects and conformance to Quality Assurance Standard section 3.05.
- C. Upon inspection of waterstop installation, replace any damaged or unacceptable waterstop and dispose of defective material.

#### 3.04 Installation

- A. Position waterstop in joint as indicated on drawings.
- B. Center waterstop on joint, with approximately one-half of waterstop width to be embedded in concrete on each side of the joint.
- C. Allow clearance between waterstop and reinforcing steel of a minimum two times the largest aggregate size. Prevent rock pockets and air voids caused by aggregate bridging.
- D. Ensure centerbulb is not embedded at expansion joints.
- E. Secure waterstop in correct position using optional factory-installed brass eyelets (or JPS hog rings crimped between last two ribs on 12 inch maximum centers), and wire tie to adjacent reinforcing steel. Center-to-center spacing may be increased upon written request and approval from ENGINEER.
- F. Carefully place concrete without displacing waterstop from proper position.
- G. Thoroughly and systematically vibrate concrete in the vicinity of the joint, and to maximized intimate contact between concrete and waterstop.
- H. After first pour, clean unembedded waterstop leg to ensure full contact of second concrete pour. Remove laitance, spillage, form oil and dirt.

#### 3.05 Quality Assurance — Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

- A. Tensile strength not less than 60 percent of parent sections.
- B. Free lap joints.
- C. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch.
- D. Misalignment which reduces waterstop cross section ore than 15 percent.
- E. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
- F. Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet.
- G. Visible porosity in the weld.
- H. Charred or burnt material.
- I. Bubbles or inadequate bonding.

- J. Visible signs of splice separation when cooled splice (24 hours or greater) is bent by hand at sharp angle.

#### APPENDIX A

Earth Shield® Thermoplastic Vulcanizate Waterstop (TPER/TPV) — Effect of 166 hour immersion (ASTM D-471) on properties of Earth Shield® Thermoplastic Vulcanizate Waterstop

Fluids	Temp., °C	Ultimate Elongation Percent Retention	Ultimate Tensile Strength Percent Retention	100% Modulus Percent Retention	Hardness, Change, Shore Units	Weight Change Percent
98% Sulfuric Acid	23	77	82	108	-1	2.1
10% Hydrochloric Acid	23	88	87	85	6	0.3
50% Sodium Hydroxide	23	101	107	104	-4	-0.1
10% Potassium Hydroxide	23	101	101	106	-1	0.1
Water	100	84	94	106	4	2.9
10% Zinc Chloride	23	89	87	83	5	0
Sea Water	23	98	107	99	4	0.3
15% Sodium Chloride	23	93	90	94	5	0.7
18% Calcium Chloride/14% Calcium Bromide, 2.5% Detergent (Tide®)	150	71	86	110	-2	-0.1
Acetic Acid	23	103	102	102	0	-0.1
Acrylonitrile	23	103	102	102	-2	3.2
Aniline	23	102	104	110	-4	0.9
Bromobenzene	23	99	94	99	-2	1.5
n-Butyl Acetate	23	94	91	88	-3	41.9
Carbon Disulfide	23	95	92	80	5	0.3
Cyclohexane	23	94	68	82	-19	60.4
Diethyl Ether	23	63	58	62	-6	45.3
Dimethylformamide	23	98	97	95	-7	-1.8
Diethyl Phthalate	23	96	105	100	6	0
1,4-Dioxane	23	101	97	103	-1	-0.2
95% Ethanol	23	98	94	95	-3	1.1
Glycerol	23	106	98	99	0	-1.7
n-Hexane	23	102	101	103	-2	-0.2
Isophorone Diisocyanate	23	90	92	94	-10	5.7
Methylethylketone	23	101	92	105	7.2	.30
Nitrobenzene	23	95	94	79	6	-4.8
Piperidine	23	100	98	102	-2	-1.5
1-Propanol	23	98	105	94	6	-1.9
Toluene Diisocyanate	23	93	98	100	6	-4.3
Pyridine	23	88	98	103	7.2	4.93
Trichloroethylene	23	98	105	94	6	-1.9
Turpentine	23	101	105	85	-13	97.2
Xylene	23	80	75	85	-10	34.8
	23	84	85	90	-11	24.9

Fluids	Temp., °C	Ultimate Elongation Percent Retention	Ultimate Tensile Strength Percent Retention	100% Modulus Percent Retention	Hardness, Change, Shore Units A	Weight Change Percent
ASTM #1 Oil	100	88	91	99	1	13.5
ASTM #1 Oil	125	70	78	91	-1	21.6
ASTM #2 Oil	100	82	86	93	-2	27.1
ASTM #2 Oil	125	65	79	93	-6	40.1
ASTM #3 Oil	100	72	75	80	-6	41.6
ASTM #3 Oil	125	60	71	83	-13	59.8
IRM 902	100	85	86	100	-5	20.8
IRM 902 <sup>2</sup>	125	71	79	97	-7	29.3
IRM 903	100	76	78	91	-9	35.4
IRM 903 <sup>2</sup>	125	60	69	84	-15	50.6
Reference Fuel A (Isooctane)	23	86	85	82	-1	13.2
Reference Fuel B (Isooctane/Toluene, 70/30)	23	82	84	81	-7	24.5
Reference Fuel C (Isooctane/Toluene, 50/50)	23	67	68	75	-4	29.4
Diesel	23	89	81	87	-11	17
JP4 Jet Fuel	23	100	71	79	-11	17
JP8 Jet Fuel	23	100	93	95	-7	8
Kerosene	23	92	85	88	-10	15
Automatic Transmission Fluid	125	63	77	82	-11	43.4
Hydraulic Brake Fluid	23	95	102	95	5	-1.8
Hydraulic Brake Fluid 2	100	89	94	97	6	-12.8
Lithium Grease	23	93	98	92	5	3.5
Lithium Grease	100	88	88	92	-7	18.8
Power Steering Fluid	125	54	59	68	-12	52.2
Antifreeze, 50/50 Ethylene Glycol (Prestone®)/water	125	84	99	96	2	3.1
Pydraul® 312	125	79	85	90	0	17.6
Skydrol® 500 B4	125	93	104	101	4	-4.2
Sunvis® 706 Fluid	125	67	77	84	-8	39.9
Ucon® CC732	125	91	99	96	2	5.3
Ucon® 50HB5100	125	91	99	96	2	5.3
Freon® 11	5	92	88	88	-9	32.3

All solution concentrations by weight.

## APPENDIX B

Earth Shield® Thermoplastic Vulcanizate Waterstop (TPER/TPV) — NSF International Drinking Water System Components — Health Effects.

**NSF International (NSF)**  
**DRINKING WATER ADDITIVES AUTHORIZED REGISTERED FORMULATION**  
**AUTHORIZED REGISTERED FORMULATION - STANDARD 61**  
**TOXICOLOGY INFORMATION SHEET**

REVISED Revised function and listing footnote

DCC: IA12497

Verified By: Jennifer Duhan (1455)

Page 1 of 2  
Issue Date 1-OCT-03

Corp. No. 1D630  
Plant No. 1D631

Company Name JP SPECIALTIES, INC. / EARTH SHIELD WATE  
Plant Address 551 BIRCH STREET  
LAKE ELSINORE CA 92530

Category: JOINING AND SEALING MATERIALS  
Function: Waterstop

Trade Designation	Size
Earth Shield Waterstop	
JP158	
JP211	
JP320L	
JP336L	
JP325T	
JP450T	
JP436	
JP636	
JP647	
JP936	
JP949	
JP678	
JP1149	
JP948	
JP648	

Water Contact Temp. CLD 23  
Water Contact Material and Code TPE

**Listing Footnotes:**

This material is approved as a waterstop for use in any potable water treatment or retaining structure.

*All information is presented in good faith and the results are believed to be accurate. All testing was done independently of Earth Shield and JP Specialties, Inc.; therefore, neither Earth Shield nor JP Specialties, Inc. makes any guarantee as to the testing data accuracy or the results obtained.*

 NSF mark denotes NSF Standard 61 certification.

END OF SECTION 031513



## SECTION 033000 – CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete with shoring and bracing
2. Formwork accessories
3. Form stripping
4. Reinforcing steel for cast-in-place concrete
5. Cast-in-place concrete including the following:
  - a. Foundations and footings
  - b. Foundation walls
  - c. Floor slabs
  - d. Retaining Walls
  - e. Equipment pads and bases
  - f. Steel pan stairs
  - g. Exterior stairs
6. Concrete curing.

B. Related Sections:

1. Division 05 Section "Steel Decking"

#### 1.2 REFERENCES

A. General:

1. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the work. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

B. American Concrete Institute (ACI):

- |    |           |  |
|----|-----------|--|
| 1. | ACI 117   | Specification for Tolerances for Concrete Construction |
| 2. | ACI 211.1 | Proportioning Concrete Mixtures                        |
| 3. | ACI 301   | Specifications for Structural Concrete                 |
| 4. | ACI 303.1 | Specification for Cast-in-Place Architectural Concrete |
| 5. | ACI 305   | Hot Weather Concreting                                 |
| 6. | ACI 306   | Specifications for Cold Weather Concreting             |
| 7. | ACI 308   | Specifications for Curing Concrete                     |
| 8. | ACI 309   | Consolidation of Concrete                              |
| 9. | ACI 318   | Building Code Requirements for Structural Concrete     |

#### 1.3 SUBMITTALS

- A. Product Data: Provide data for proprietary materials, including admixtures curing materials, and finish materials.
- B. Submit Placement Shop Drawings, showing location of construction joints. Clearly indicate the construction joints in different locations than those shown in the drawings.
- C. Samples: As requested by testing laboratory.

- D. Mix design for each concrete mix.
- E. Include compression test data used to establish mix proportions.
- F. Submit certification that the facilities of the ready-mix plant comply with the requirements of ASTM C94.
- G. Material Certificates.
  - 1. Cementitious materials, including supplemental cementitious material.
  - 2. Aggregates, including gradation and combined gradation.
  - 3. Admixtures. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
- H. Submit ticket to Testing Laboratory for each batch of concrete delivered.
  - 1. Mix identification.
  - 2. Weights of cementitious materials, aggregates, water and admixtures, and aggregate size.

#### 1.4 QUALITY ASSURANCE

- A. Standards: Comply with provisions of ACI 301, except where more stringent requirements are indicated. Evaluation and acceptance of concrete structures will be in accordance with ACI 301.
- B. Concrete Mix Design: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected. Each mix shall be identified as it will appear on batch tickets delivered to project site.
  - 1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
  - 2. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength.
  - 3. Indicate quantity of each ingredient per cubic yard of concrete.
  - 4. Indicate type and quantity of admixtures proposed or required.
- C. Certificates of Compliance: Acceptability of the following materials will be based upon documentation furnished by the manufacturer identifying each batch of material and certifying compliance with the requirements specified:
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Chemical admixtures.
- D. Certified Laboratory Test Reports: Before delivery of materials submit certified copies of the reports of the tests required in referenced standards or otherwise specified here. The testing shall have been performed by an independent laboratory within one year of submittal of test reports for approval. Test reports on a previously tested material shall be accompanied by certificates from the manufacturer certifying that the previously tested material is of the same type, quality, manufacture and make as that proposed for use in the project. Certified test reports are required for the following:

1. Portland Cement.
2. Aggregates.
3. Admixtures.

E. Survey anchor bolts for placement and alignment prior to casting concrete.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site bundled and tagged with metal tags, indicating bar size, lengths, and other data corresponding to information shown on placement drawings.
- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.
- C. Store cementitious materials in a dry, weathertight location. Maintain accurate records of shipment and use.
- D. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

#### 1.6 PROJECT CONDITIONS

- A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.
  1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.
- B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 305.
  1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and windbreaks.

### PART 2 - PRODUCTS

#### 2.1 FORMWORK

- A. Facing Materials:
  1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete.
  2. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances.
- B. Formwork Accessories:
  1. Foam coating: Foam release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
  2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch-diameter hole in concrete surface.

3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: Provide deformed bars complying with ASTM A615, Grade 60, except where otherwise indicated.
- B. Reinforcing Bar Mats: ASTM A184.
- C. Welded Wire Fabric: ASTM A1064, cold-drawn steel, plain.
- D. Reinforcing Accessories:
  1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
  2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice."
    - a. Class 1 (plastic protected) where legs of wire bar supports contact forms.
    - b. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

## 2.3 CONCRETE MATERIALS

- A. Cementitious materials and aggregates for exposed concrete shall be from same source throughout the work.
- B. Cementitious Material: An intimate blend of Portland cement and supplemental cementitious material. Cementitious material shall include a maximum of 15 percent fly ash or ground blast furnace slag by weight unless the strength is specified to be achieved in 7 or 14 days. Cementitious material shall comply with ACI 318 Chapter 4 requirements for exposure class S1.
- C. Portland Cement: ASTM C150 and as follows:
  1. Type I except where other type is specifically permitted or required.
    - a. Type I can be replaced by Type III (high early strength) for concrete placed during cold weather.
- D. Supplemental Cementitious Materials:
  1. Fly Ash: ASTM C618, Class F with the following Modified ASTM requirements:
    - a. Loss of Ignition (L.O.I.): maximum 1 percent.
    - b. Sulfur Trioxide (SO<sub>3</sub>) shall not exceed 3 percent by weight.
  2. Ground Blast Furnace Slag: ASTM C989.
- E. Aggregates
  1. Normal weight concrete: ASTM C33.
    - a. Class S3
  2. Light weight concrete: ASTM C330.
  3. Maximum size of coarse aggregate, whichever is least:
    - a. One-fifth narrowest dimension between sides of forms.
    - b. Three-fourths of minimum clear distance between reinforcing bars or between bars and side of form.

- c. Columns and piers: Two-thirds of minimum clear distance between bars.
- F. Water: Mixing water shall be clean, potable and free from deleterious material.
- G. Admixtures - General
  - 1. Admixtures containing more than 0.1 percent chloride ions are not permitted.
  - 2. Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized.
  - 3. Liquid admixtures shall be considered part of the total water.
- H. Water Reducing Admixture: ASTM C494, Type A. Provide in all concrete at necessary dosage to facilitate placement.
- I. Mid to High Range Water Reducing Admixture: ASTM C494, Type F; polycarboxylate formulation. Provide in mid-range or high-range dosage as necessary for placement at the maximum water to cement ratio specified.
- J. Set Accelerating Admixture: ASTM C494, Type E, non-chloride. Subject to approval of engineer, provide in necessary dosage to accelerate set.
- K. Set Retarding Admixture: ASTM C494, Type D. Subject to approval of engineer, provide in necessary dosage to retard set.
- L. Fibrous Reinforcement: Polypropylene fibers designed and engineered specifically for secondary reinforcement of concrete.

## 2.4 ACCESSORIES

- A. Curing Compounds: ASTM C309, Type 1 which will not discolor concrete or affect bonding of other finishes applied, and which restricts loss of water to not more than 0.500 grams per square centimeter of surface when tested per ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."
- B. Bonding Compound: Non-redispersible acrylic bonding admixture, ASTM C1059, Type II.
- C. Slab Curing Membrane: Membrane conforming to ASTM C171, non-staining.
- D. Burlap Sheet: AASHTO M182, class 3 or 4.
- E. Vapor Barrier: ASTM D2103, "Polyethylene Film and Sheeting."
- F. Grout: ASTM C1107, Grade B non-shrink, non-metallic, prepackaged grout.
- G. Waterstops: Provide waterstops at construction joints and as otherwise indicated, sized and configured to suit joints.
- H. Expansion Joint Filler: Nonextruding bituminous type: ASTM D1751.

## 2.5 CONCRETE MIXES

- A. Proportioning of Concrete: Comply with recommendations of ACI 211.1.
- B. Required Average Strength: Establish the required average strength of the design mix on the basis of either field experience or trial mixtures as specified in ACI 301, and

proportion mixes accordingly. If trial mixture method is used, employ an independent testing agency acceptable to the engineer for preparing and reporting proposed mix design.

- C. Specified compressive strength  $f'(c)$  at 28 days:
  - 1. Foundations and footings: 4000 psi.
  - 2. Walls, columns, suspended slabs, and beams: 4000 psi.
  - 3. Floor slabs on grade: 4000 psi
  - 4. Concrete fill on metal deck: 4000 psi.
  - 5. Miscellaneous curbs and pads: 4000 psi.
- D. Slump: The concrete mix design shall provide for a concrete slump appropriate to the project conditions. The concrete shall be sufficiently fluid to allow for ease of placement and sufficiently stiff to prevent segregation.
- E. Fibrous Reinforcement: Where specified or approved, add to mix at rate recommended by manufacturer for specific application.
  - 1. Add to concrete mix in lieu of providing welded wire fabric reinforcement for interior floor slabs, at contractor's option and with prior approval of engineer.
- F. Water to Cementitious Material Ratio: Water-to-cementitious-material ratio shall not exceed 0.45 by weight. Weight of water shall include all free moisture, including liquid admixtures.
- G. Air-entraining admixture: Use in mixes for exterior exposed concrete unless otherwise specifically indicated. Add at rate to achieve total air content of 6 percent. For concrete not exposed to exterior, add at rate to achieve total air content between 2 percent and 4 percent.
- H. Water-reducing admixture: Add as required for placement and workability.
- I. Water-reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.
- J. Water-reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.
- K. High-range water-reducing admixture (superplasticizer): As required for placement and workability.
- L. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for approval requirements for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

## 2.6 CONTROL OF MIX IN THE FIELD

- A. Slump: A tolerance of up to 1 inch above approved design mix slump will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.
- B. Total Air Content: A tolerance of plus or minus 1 percent of approved design mix air content will be allowed for field measurements.

- C. Do not use batches that exceed tolerances.

## PART 3- EXECUTION

### 3.1 FORMWORK ERECTION

- A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.
- B. Earth forms: Hand trim sides and bottom of earth forms; remove loose dirt.
- C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Construction: Construct and brace formwork to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.
  - 1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
    - a. Align joints symmetrically at exposed conditions.
  - 2. Chamfers: Provide chamfered edges and corners at exposed locations, unless specifically indicated otherwise on the drawings.
  - 3. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
  - 4. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.
- E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.
- F. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use.

### 3.2 REINFORCEMENT AND EMBEDDED ITEMS

- A. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.
- B. Placement: Place reinforcement to achieve not less than minimum concrete coverage as required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class B tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.
  - 1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.

2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.
- C. Welding: Welding of reinforcement is not permitted.
- D. Installation tolerances for anchor bolts for structural steel columns shall comply with the AISC Code of Standard Practice for Steel Buildings and Bridges.

### 3.3 JOINT CONSTRUCTION

- A. Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance.
  1. Keyways: Provide keyways not less than 1-1/2 inches deep.
  2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
  3. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with field joints fabricated in strict accordance with manufacturer's instructions.
- B. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant and backer rod where necessary.

### 3.4 PLACING CONCRETE

- A. The rate of delivery, haul time, missing time and hopper capacity shall be such that all mixed concrete delivered shall be placed in forms within 90 minutes from the time of the introduction of cement and water into the mixer.
- B. No water shall be added after transit mixer leaves the batching.
- C. Prepare previously placed concrete by cleaning and applying bonding agent in accordance with manufacturer's instruction.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy grout.
- E. Foundation surfaces against which concrete is to be placed must be free from standing water, mud and debris. Surfaces shall be clean and free from oil, objectionable coatings, and loose or unsound material.
- F. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
  1. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
  2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
  3. Do not use vibrators to move concrete laterally.



- G. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.
  - 1. Do not use frozen or ice-laden materials.
  - 2. Do not place concrete on frozen substrates.
- H. Hot Weather Placement: Comply with recommendations of ACI 305 when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.
  - 1. Do not add water to approved concrete mixes under hot weather conditions.
  - 2. Provide mixing water at lowest feasible temperature and provide adequate protection of poured concrete to reduce rate of evaporation.
  - 3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

### 3.5 FLOOR SLABS

- A. Place floor slabs on grade as indicated on drawings. Saw cut control joints at an optimum time after finishing. Cut slabs with a 3/16-inch (8 mm) thick blade to 1 inch (25 mm) depth. Locate control joints at a maximum spacing of 36 times the slab depth and at each corner and plan irregularity.
- B. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- C. Construct slab on grade and shored elevated floor slabs with overall specified FF30/FL20 and with minimum FF15/FL10 for individual floor sections in accordance with ACI 302.1. Determination of FF/FL numbers will be in accordance with ASTM E 1155. The contractor will take remedial measures when floor slabs do not meet specified requirements.

### 3.6 FINISHING FORMED SURFACES

- A. Repairs: Repair surface defects, including tie holes, immediately after removing formwork.
  - 1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
  - 2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal Portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.
- B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding 1/4 inch height.
- C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.

1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
  2. Wet concrete surfaces to be finished and rub with abrasive until uniform color and texture are achieved.
  3. Do not apply separate grout mixture.
- D. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaced adjacent to or contiguous with formed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

### 3.7 CURING AND PROTECTION

- A. Working and walking on concrete shall be avoided for at least 24 hours after casting. Protect concrete from sun and rain. Do not permit concrete to become dry during curing period. Concrete shall not be subjected to any loads until concrete is completely cured, and until concrete has attained its 28 day strength and 14 days minimum.
- B. Protect concrete during and after curing from damage during subsequent building construction operations.
- C. Cover traffic areas with plywood or other suitable means for as long as necessary to protect concrete from damage.
- D. Immediately upon completion of finishing operation, the surface of slabs shall be sealed against moisture loss by the application of one of the following methods for 7 days:
1. Apply a curing blanket made of polyethylene bonded to burlap in accordance with the manufacturer's instructions.
  2. Apply waterproof curing paper with edges lapped and sealed with tape. The curing membrane shall be weighted down. Tears and rips in curing membrane shall be repaired immediately during curing period.
- E. Specific curing requirements for walls, beams and columns shall include the following:
1. Concrete in forms shall be kept moist until removal.
  2. Immediately upon removal of forms, an approved sprayed-on curing compound shall be applied to the concrete surfaces in strict compliance with the manufacturer's recommendations.
  3. Curing shall be maintained for 7 days.

### 3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.
- B. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Screed, tamp, and finish concrete surfaces as scheduled.
- C. Reinforced Masonry: Provide concrete grout for reinforced masonry where indicated on drawings and as scheduled.

### 3.9 FIELD QUALITY CONTROL

- A. Composite Sampling and Making and Curing of Specimens: ASTM C172 and ASTM C31.
  - 1. Take samples at point of discharge.
  - 2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at point of delivery shall be used for acceptance of concrete.
  - 3. Take samples and perform tests for concrete before and after field addition of admixtures. Report results of all tests.
- B. Slump: ASTM C143. Test first 2 loads delivered for each pour and 1 test per strength test and additional tests if concrete consistency changes.
  - 1. Modify sampling to comply with ASTM C94.
  - 2. For concrete containing superplasticizer added at the job site, perform slump test prior to addition of admixture and after mixing. Report both test results.
  - 3. Visual estimate of slump may be accepted once uniform results are achieved over a minimum of 4 samples. Report all estimated results as such.
- C. Air Content of concrete: ASTM C173 or ASTM C231. Test first 2 loads delivered for each pour and one test per strength test performed on air-entrained concrete.
- D. Concrete Temperature:
  - 1. Test hourly when air temperature is 40 degrees F or below.
  - 2. Test hourly when air temperature is 90 degrees F or above.
  - 3. Test each time a set of strength test specimens is made.
- E. Compressive Strength Tests: ASTM C39.
  - 1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
  - 2. Testing for acceptance of potential strength of as-delivered concrete:
    - a. Obtain samples on a statistically sound, random basis.
    - b. Provide one test per 50 cubic yards or fraction thereof for each day's pour of each concrete class.
    - c. Provide one test per 2500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.
    - d. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches or from each batch if fewer than 5.
    - e. Test one specimen per set at 7 days for information unless an earlier age is required.
    - f. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the engineer.
    - g. Retain one specimen from each set for later testing, if required.
    - h. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:

- i. No individual test result falls below specified compressive strength by more than 500 psi.
    - ii. Not more than 10 percent of individual test results fall below specified compressive strength.
    - iii. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength.
  - i. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.
- F. Test Results: Testing agency shall report field and laboratory test results in writing to engineer and contractor within 24 hours of test.
- 1. Field test results which do not comply with the project specifications shall be immediately reported to project superintendent. Field reports shall include documentation of all such reports and the name of the person results were reported to.
  - 2. Test reports shall contain the following data:
    - a. Project name, number, and other identification.
    - b. Name of concrete testing agency.
    - c. Date and time of sampling.
    - d. Concrete type and class.
    - e. Location of concrete batch in the completed work.
    - f. All information required by respective ASTM Test methods.
    - g. Concrete mix parameters and tolerances.
  - 3. Nondestructive testing may be used at engineer's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
  - 4. The testing agency shall make additional tests of in-place concrete as directed by the engineer when test results indicate that specified strength and other concrete characteristics have not been attained.
    - a. Testing agency may conduct tests of cored cylinders complying with ASTM C42, or tests as directed.
    - b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.

END OF SECTION 033000

## SECTION 035400 – CONCRETE UNDERLAYMENT PATCH

### PART I – GENERAL

#### 1.01 SUMMARY

- A. This is the recommended specification for ARDEX SD-P InstantPatch, Self-Drying, Fast-Setting, Concrete Underlayment Trowelable Patch for smoothing and repairing concrete floors, ramps, stairways, as well as non-porous substrates such as terrazzo, ceramic and quarry tile prior to the installation of floor covering.

#### 1.02 SECTION INCLUDES

- A. ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch.
- B. ARDEX LU-100 Self-Leveling Floor Underlayment
- C. ARDEX P-51 Primer
- D. ARDEX P-82 Ultra Prime.
- E. Architect/Engineer Approved Equal.

#### 1.03 QUALITY ASSURANCE

- A. Installation of the cement-based, self-drying, fast-setting trowelable underlayment patch must be made by the applicator using mixing equipment and tools approved by the manufacturer.
- B. Installation of the hydraulic cement-based, self-leveling underlayment must be by an applicator using mixing equipment and tools approved by the manufacturer.
- C. Provide ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch as manufactured by ARDEX INC., 400 Ardex Park Drive, Aliquippa, PA 15001.
- D. Underlayment shall be installed from a featheredge to ¼" over any size area, up to ½" in areas of 20 sq. ft. or less and up to 1" deep in areas up to 4 sq. ft.
- E. Underlayment shall be able to be installed from a featheredge to 2" in one pour and up to 5" thick in small areas.
- F. Underlayment shall develop a minimum compressive strength of 4200 psi after 28 days per ASTM C109/mod (air cure only).
- G. No primer is required for underlayment when used over standard absorbent concrete.
- H. Underlayment shall be able to be covered by most flooring materials as soon as the surface is sufficiently hardened (usually within an hour). Parquet, athletic flooring and flooring requiring special adhesives shall be installed in 16 hours.
- I. Underlayment shall be walkable after 3 hours at 70°F and be able to be covered by finish flooring material in 2-3 days, depending upon thickness of installation.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

#### 1.05 SITE CONDITIONS

- A. ARDEX SD-P is a cementitious material. Observe the basic rules of concrete work. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the ARDEX Technical Service Department. Never mix with cement or additives other than ARDEX-approved products.
- B. ARDEX LU-100 contains blended hydraulic cements and powdered polymers. Do not install in applications on or below grade unless the concrete substrate has already been treated with ARDEX MC™ MOISTURE CONTROL SYSTEM or approved equal. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the Ardex Technical Service Department. Never mix with cement or additives.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. The Portland cement-based, self-drying, fast-setting, trowelable underlayment patch shall be ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch.
- B. No primer required over standard absorbent concrete.
- C. Primer for non-porous, and highly smooth substrates, shall be ARDEX P-82 Ultra Prime.
- D. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).
- E. The hydraulic cement-based self-leveling underlayment shall be ARDEX LU-100 SELF-LEVELING FLOORING UNDERLAYMENT.
- F. Primer for standard absorbent concrete subfloors, well bonded patching compounds, and other porous surfaces shall be ARDEX P 51 PRIMER diluted 1:1 with water.
- G. Primer for well-bonded, non-water soluble adhesive residues shall be ARDEX P 51 PRIMER undiluted or ARDEX P 82 ULTRA PRIME.
- H. Primer for all other non-porous surfaces to include terrazzo, burnished or sealed concrete, ceramic and quarry tile, acrylic curing compounds, and epoxy coatings shall be ARDEX P 82 ULTRA PRIME.
- I. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F)
- J. Repair of small gouges, indentations and holes, as well as skim coating large areas, can be done using ARDEX FEATHER FINISH® SELF-DRYING, CEMENT-BASED FINISHING UNDERLAYMENT.

#### 2.02 MIX DESIGNS

- A. Mixing Ratios: Standard mixing ratio: Mix 1 bag of ARDEX SD-P (40 lbs.) with 4 quarts of water. Product can be mixed in a clean 5-gallon pail using ARDEX T-2 Mixing Paddle and a ½" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per ARDEX SD-P bag label.
- B. Underlayment shall be installed using a wood or magnesium float. When underlayment begins to harden, finish with a steel trowel.
- C. Underlayment can receive floor covering as soon as the surface becomes sufficiently hard (about 1 hour). Parquet, athletic flooring and flooring requiring special adhesives can be installed in 16 hours.
- D. Mixing Ratio: ARDEX LU-100 is mixed in 2-bag batches at one time. Mix each bag of ARDEX LU-100 (50 lb.) with 4 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-4 Mixing Paddle and a ½" heavy-duty drill (min. 650rpm). Mix thoroughly for approx. 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX LU-100 bag label.
- E. For pump installations, ARDEX LU-100 shall be mixed using the ARDEX Levelcraft Automatic Mixing Pump. Start the pump at 130 gallons of water per hour, then adjust to the minimum water reading which still allows self-leveling properties. DO NOT OVERWATER! Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid overwatering.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. All surfaces must be sound, solid, cleaned, and where required, properly primed.
- B. All concrete subfloors must be of adequate strength, clean, and free of oil, grease, dirt, curing compounds, and any substance, which might act as a bondbreaker. Mechanically clean, if necessary, using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.
- C. All non-porous substrates such as ceramic tile, terrazzo, etc., must be well bonded, clean and free of wax, dressings and sealers. If necessary, have the surface professionally cleaned.
- D. All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.
- E. Substrates shall be tested and corrected for moisture and for any other condition, which could affect the performance of the underlayment and the finish floor covering, before installing the patch.
- F. All concrete subfloors and concrete floors with existing patching must be solid, sound, solid, thoroughly cleaned, and properly primed.
  - 1. All concrete subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance, which might act as a

bondbreaker. Mechanically clean, if necessary, using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.

2. All cracks in the subfloor shall be repaired to minimize telegraphing into the underlayment.
3. Subfloors shall be inspected and corrected for moisture or any other conditions which could affect the performance of the underlayment or finished floor covering.

G. Priming

1. No primer required for porous concrete floors.
2. Primer for non-porous substrates.
3. Prime with ARDEX P-82 Ultra Prime. Mix Part A (red) and Part B (white) and apply evenly with a short-nap or foam paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tacky film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until primer is dry.
4. Primer coverage approximately 200 to 400 square feet per gallon.

H. Priming ARDEX LU-100 Priming

1. Extremely absorbent substrates
  - i. Mix ARDEX P-51 3:1 with water and apply evenly with a soft pushbroom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (One to three hours). Second coat of Primer shall not be applied until initial primer application is completely dry.
  - ii. Mix ARDEX P-51 1:1 with water and apply evenly with a soft pushbroom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (minimum 3 hours, maximum 24 hours). ARDEX LU-100 Underlayment shall not be installed until second primer application is completely dry.
2. Non-water soluble adhesive residues – Use ARDEX P 51 PRIMER at full strength and install as above.
3. Non-porous substrates: Prime with ARDEX P 82 ULTRA PRIME. Mix Part A (red) with Part B (white) and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tack film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Primer coverage is approximately 200 to 400 square feet per gallon.

### 3.02 APPLICATION OF UNDERLAYMENT

- A. Pour or pump the ARDEX LU-100 and spread with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball shoes with nonmetallic cleats to avoid leaving marks in the ARDEX LU-100. Underlayment can be carefully walked on in 3 hours at 70°F.



### 3.03 PREPARATION FOR FLOORING INSTALLATION

- A. Underlayment can accept finish floor covering materials after 2-3 days at 70°F/50% R.H. depending upon thickness. Perform a moisture test in accordance with ASTM D4263 before installing the finish flooring.

### 3.04 FIELD QUALITY CONTROL

- A. Where specified, field sampling of the Ardex topping is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

### 3.05 PROTECTION

- A. Prior to the installation of the finish topping, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION 035400



## SECTION 035416 – CEMENT-BASED, INTERIOR, SELF LEVELING UNDERLAYMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

#### 1.02 SUMMARY

- A. Cement-based, interior, self-leveling underlayment.

#### 1.03 SECTION INCLUDES

- A. Cement-based, interior, self-leveling underlayment used to create a smooth, flat or level surface prior to the installation of floor coverings.
  - 1. Cement-based, interior, self-leveling underlayment
  - 2. Primer
  - 3. Vapor mitigation product
  - 4. Fiber reinforcement material
  - 5. Finishing underlayment compound
- B. Related Sections include the following:
  - 1. Section 033000, Cast-In-Place Concrete
  - 2. Division 09 Flooring Sections

#### 1.04 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with all applicable requirements and standards.
- D. ASTM C109M, Compressive Strength Air-Cure Only
- E. ASTM C348, Flexural Strength of Hydraulic Cement Mortars
- F. ASTM C190, Method of Test for Tensile Strength of Hydraulic Cement Mortars

- G. ASTM C1583, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension
- H. ASTM C4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- I. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes
- J. ASTM F1869, Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- K. ASTM 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- L. Resilient Floor Covering Institute booklet "Recommended Work Practices for the Removal of Resilient Floor Coverings"

#### 1.05 QUALITY ASSURANCE

- A. Installation of CMP SPECIALTY PRODUCTS LEVEL-1 must be by a trained applicator regularly engaged and properly equipped for application of concrete floor underlayment. Please contact your local CMP SPECIALTY PRODUCTS distributor for a list of Installers.
- B. Product shall be able to be installed from ¼ inch to 3 inches thickness neat and up to 5-inches properly extended with aggregate over well-defined areas.
- C. Product shall be formulated to develop a compressive strength of 5000 psi when tested in accordance with ASTM C109/modified for air-cured conditions.
- D. Product shall be able to be covered by thinset ceramic tile in 24 hours, water-based sealers and adhesives for standard coverings in 48 hours, epoxy or urethane adhesives and moisture sensitive coverings in 3 to 5 days. For application of epoxy coatings < 20 mils: 24 hours and high build epoxy coatings > 20 mils: 5 to 7 Days. Always ensure underlayment is totally dry especially when using moisture sensitive adhesive and floor coverings.
- E. Product produces a hard-durable surface that can be left open to normal construction traffic for up to one year before the installation of finished flooring. CMP SPECIALTY PRODUCTS LEVEL-1 can be feather edged to meet existing transitions.

#### 1.06 SUBMITTALS

- A. Product Data: Product data in the form of technical data, specifications, and installation instructions.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.
- C. Do not use which shows indications of moisture damage, caking, or other signs of deterioration.

## 1.08 PROJECT CONDITIONS

- A. Do not place the product when ambient temperature is below 50 degrees F (10 degrees C) or above 95 degrees F (35 degrees C).

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

### 2.02 MATERIALS

- A. Self-Leveling Underlayment: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1/4 inch to 3 inches. Applications up to 5 inches in thickness properly extended with aggregate.

#### BASIS OF DESIGN

- 1. CMP SPECIALTY PRODUCTS “LEVEL-1”
  - a. Flow Working Time: 25 minutes
  - b. Final Set: Approximately 90 minutes, ASTM C191
  - c. Compressive Strength:
    - i. 1500 psi at 1 day, ASTM C109M
    - ii. 3000 psi at 7 days, ASTM C109M
    - iii. 5000 psi at 28 days, ASTM C109M
  - d. Flexural Strength: 1000 psi at 28 days, ASTM 348
  - e. Tensile Strength: 520 psi at 28 days, ASTM C190
  - f. VOC: 0g/L, calculated SCAQMD 1168
- 2. Architect Approved Equal
- B. Underlayment Primer: Premium primer designed for use with CMP’s line of underlayments and toppings.
  - 1. CMP SPECIALTY PRODUCTS “AS-100”
  - 2. CMP SPECIALTY PRODUCTS “LOCKDOWN” with sand broadcast. Note: CMP SPECIALTY PRODUCTS LOCK DOWN with sand broadcast is required for applications subject to dynamic rolling loads and when CMP SPECIALTY PRODUCTS LEVEL-1 is used as a prefill for CMP SPECIALTY PRODUCTS DIAMOND CAP installations.
- C. Vapor Mitigation and Remediation Product: 100% solids, two-component, resin based, membrane forming, moisture mitigation system.

1. CMP SPECIALTY PRODUCTS "LOCKDOWN"

- D. Redispersible Fiber Mat: Fiber reinforcement mat for use with wood, unstable and distressed subfloors.

1. CMP SPECIALTY PRODUCTS "MEDIMAT"

- E. Finishing Underlayment Compound: Trowelable, cement-based smoothing compound for applications from feather edge to ½ inch thick.

1. CMP SPECIALTY PRODUCTS "PREPSTAR"

- F. Polished, Self Leveling Topping: Calcium Aluminate/Portland cement based self-leveling topping for applications from 1/4 inch to 2 inches thickness and suitable to receive a mechanical concrete polish process.

1. CMP SPECIALTY PRODUCTS DIAMOND CAP

- G. Self Leveling Topping: Premium free-flowing, self-leveling, pumpable, calcium aluminate/Portland cement-based compound for applications from 1/8 inch to 1/2 inch thickness.

1. CMP SPECIALTY PRODUCTS LIQUICEM

- H. Aggregate: For extension on CMP SPECIALTY PRODUCTS LEVEL-1 in 3 inch to 5 inch thick applications.

2.03 MIXING EQUIPMENT

- A. Provide suitable batch type mechanical mixer for mixing topping material at the Project Site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water-measuring device. Use only mixers which are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.
- B. Provide suitable mixing-pump such as m-tec, Duo 2000 which includes dual mixing action and wet material probe for consistent mix water monitoring.
- C. Provide a suitable barrel, to mix 2-bag batches of product. Provide a suitable dispensing container for measuring a maximum 5.5 quarts of clean cold water for each bag of product. Provide a heavy duty 1/2" drill (min. 850 rpm) with product mixing wand to mix product to a lump free consistency without entraining excess air.

PART 3 - EXECUTION

3.01 PREPARATION (BASIS OF DESIGN PRODUCT)

- A. Concrete subfloors: Prepare substrate in accordance with CMP SPECIALTY PRODUCTS' instructions.
1. Refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring before proceeding.

2. Concrete subfloors must be sound, clean and free of all dirt, oil, grease, laitance, curing compounds and any substance that may act as a bond breaker. If necessary, mechanically clean and remove contaminants by chipping, shot-blasting, grinding or scarifying. Removal with solvents, strippers and acid etching are not acceptable.
  3. All cracks in the subfloor must be repaired or treated to minimize crack telegraphing through the underlayment/topping. Moving cracks, working cracks, expansion joints and isolation joints must be honored through the applied CMP SPECIALTY PRODUCTS LEVEL-1.
  4. Substrates shall be inspected and tested for moisture in accordance with ASTM F1869 and/or ASTM 2170. Substrates must be corrected for moisture or any other conditions that could affect the underlayment/topping performance or finished floor covering. Utilize CMP SPECIALTY PRODUCTS LOCKDOWN topical moisture vapor mitigation system where moisture and vapor emissions exceed the floor covering manufacturer's required limits.
- B. Wooden subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
1. Must be a minimum of ¾ inch, untreated, APA Rated, Type-1, exterior grade plywood, OSB or equal. The subfloor must be free of deflection (L/360 maximum) considering both live and dead loads. Subfloor must be clean, sound and free of all foreign matter that will inhibit bond.
  2. Prepare by sanding down to bare wood. Secure loose boards with deck screws and fill open seams with CMP SPECIALTY PRODUCTS PREPSTAR. Replace any weak or water damaged wood.
  3. Use an approved anti-fracture membrane over CMP SPECIALTY PRODUCTS LEVEL-1 in areas where Ceramic Tile or Stone are being installed.
- C. Non-Porous floors: Epoxy, Terrazzo, and ceramic and quarry tile must be abraded to a dull finish. Vacuum or wet vacuum the surface to remove dust and laitance.
- D. Adhesive residue: Thin, translucent adhesive residue must be non-water soluble, free of tack and well bonded to the substrate. The adhesive Cutback must be prepared using the wet scrape method as outlined in the Resilient Floor Covering Institute booklet "Recommended Work Practices for the Removal of Resilient Floor Coverings". Remove all patching materials below the adhesive and avoid applications where heat or excessive moisture will soften or degrade the adhesive. If unsure about the suitability, deflection or if heavy loads are expected, use the VERY DISTRESSED SUBFLOORS Application Method below.
- E. Very distressed subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat for use with wood, unstable and distressed subfloors.
1. ALL substrates must be clean, dry, between 50° and 95°F (10° and 30°C) and free of oil, loose (floorcovering, patching compounds or surface material). Remaining materials must be unaffected by the moisture incurred from the placement of self-leveling. Never use Acid or Mastic Removers on any surface to which a CMP product will be applied.

- F. Gypsum substrates: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
  - 1. Remove all loose debris from subfloor. Sweep and vacuum the substrate.
- G. Metal substrates: Substrate must be prepared by abrasive cleaning to a White metal finish, structurally sound and free of deflection (L/360 maximum). Remove all residue using a dry cleaning method or wipe down with Xylene.

### 3.02 INSTALLATION (BASIS OF DESIGN PRODUCT)

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with CMP SPECIALTY PRODUCTS published recommendations.
- C. Concrete subfloors: Apply one coat of CMP SPECIALTY PRODUCTS AS-100 diluted 50/50 (1 part water: 1 part CMP SPECIALTY PRODUCTS AS-100) using a split tip broom. Pour out and work into surface leaving no puddles or bare spots. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 1 hour) and up to 24 hours. If primer has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- D. Wooden subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
  - 1. Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
  - 2. Roll out CMP SPECIALTY PRODUCTS MEDIMAT over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2". Mat installation does not need to be "Wrinkle Free" as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
  - 3. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
  - 4. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
  - 5. Finish with a CMP SPECIALTY PRODUCTS smoother.



6. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.
- E. Non-Porous floors: Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a ¼ inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 1 hour) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- F. Adhesive residue: Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- G. Very distressed subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
  1. Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
  2. Roll out CMP SPECIALTY PRODUCTS MEDIMAT™ over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT™ can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2 inches. Mat installation does not need to be “Wrinkle Free” as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
  3. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
  4. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
  5. Finish with a CMP SPECIALTY PRODUCTS smoother.
  6. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.
- H. Gypsum substrates: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT redispersible fiber reinforcement mat.

1. The first primer coat should be diluted and applied at 1 part CMP SPECIALTY PRODUCTS AS-100: 3 parts water using a split tip Broom. Pour out and work into surface leaving no puddles or bare spots.
2. After initial coat is dry (Minimum 1 hour) apply the second coat of CMP SPECIALTY PRODUCTS AS-100 diluted 50/50 (1 part water: 1 part CMP SPECIALTY PRODUCTS AS-100) using a split tip broom. Pour out and work into surface leaving no puddles or bare spots.
3. Install CMP SPECIALTY PRODUCTS MEDIMAT™ as per TDS once CMP SPECIALTY PRODUCTS AS-100 is completely dry (Minimum 2 hours) and up to 24 hours. If Primer has dried longer than 24 hours, an additional coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
4. Roll out CMP SPECIALTY PRODUCTS MEDIMAT™ over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT™ can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2 inches. Mat installation does not need to be “Wrinkle Free” as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
5. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
6. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
7. Finish with a CMP SPECIALTY PRODUCTS smoother.
8. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.

### 3.03 MIXING (BASIS OF DESIGN PRODUCT)

- A. Use CMP SPECIALTY PRODUCTS mixing drum, to mix 2-bag batches of CMP SPECIALTY PRODUCTS LEVEL-1. Add a maximum 5.5 quarts of clean cold water for each bag of CMP SPECIALTY PRODUCTS LEVEL-1 to the mixing drum or barrel. Then, add bags of CMP SPECIALTY PRODUCTS LEVEL-1 while mixing at full speed with a CMP SPECIALTY PRODUCTS mixing wand attached to a heavy duty ½ inch drill (min. 850 rpm). Mix for 2 minutes or until lump free. Add no additional water and keep the mixing wand immersed in the material to avoid entraining excess air.
- B. Aggregate mix: For installation areas over 2 inches (5 cm) in thickness, up to 1 part by volume of well graded, washed pea gravel must be added. Aggregates should be hard, high density and non-absorbent. Before attempting to use any aggregate, conduct testing to determine suitability. All aggregate should be clean and dry. Do not use sand or exceed 1 part aggregate by volume. Combine aggregate once material is lump free and mix until aggregate is completely coated. Aggregate addition will diminish workability and

may make it necessary to install a finish layer. Allow the first installation to dry 12 to 16 hours before topping.

- C. For pump installations, please contact CMP SPECIALTY PRODUCTS for instructions, recommended pumping procedures and approved equipment.

#### 3.04 PLACING (BASIS OF DESIGN PRODUCT)

- A. Place underlayment in accordance with CMP SPECIALTY PRODUCTS' instructions, using equipment and procedures to facilitate continuous placement, avoid segregation of mix and prevent excessive air content. Pour or pump, gauge rake with a CMP SPECIALTY PRODUCTS gauge rake and smooth with a CMP SPECIALTY PRODUCTS smoother in a continuous operation until an entire panel or section of floor area are completed. Do not work mix except for raking or smoothing.

#### 3.05 CURING AND PROTECTION (BASIS OF DESIGN PRODUCT)

- A. Cure and protect CMP SPECIALTY PRODUCTS LEVEL-1 underlayment/topping applications and finishes as specified CMP SPECIALTY PRODUCTS. CMP SPECIALTY PRODUCTS LEVEL-1 is self-curing. Do not use cure & seals or any other curing methods.
- B. During application and for the first 24 hours, prevent excessive air movement but maintain adequate ventilation and protect material from direct sunlight to prevent uneven curing patterns, false set and cracking.

#### 3.06 PERFORMANCES (BASIS OF DESIGN PRODUCT)

- A. Failure of CMP SPECIALTY PRODUCTS LEVEL-1 to bond to substrate, or disintegration or other failure of topping to perform as a floor underlayment or topping compound will be considered failure of materials and/or workmanship. Repair or replace CMP SPECIALTY PRODUCTS LEVEL-1 in areas of such failures, as directed by CMP SPECIALTY PRODUCTS.

END OF SECTION 035416



## SECTION 040110 – MASONRY CLEANING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Cleaning existing brick, concrete masonry, and stone.
- B. Cleaning new brick, concrete masonry, and stone.

#### 1.2 RELATED SECTIONS

- A. Section 040120 – Unit Masonry Restoration.
- B. Section 040122 – Stone Restoration.

#### 1.3 REFERENCES

- A. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound Content of Paints and Related Coatings; 1996.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B.
- C. Product Data: Manufacturer's printed literature for each product, including test data indicating compliance with requirements, and installation instructions.
- D. Restoration Plan: Written description of restoration process, including materials, methods, equipment, and sequencing of work.
- E. Cleaning Plan: Written description of cleaning process, including materials, methods, equipment, and sequencing of work.
- F. Installer's qualifications.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Capable of providing field service representation during installation and who will approve the installer and application method.
- B. Installer Qualifications: Installer experienced in performing this type of work and who has specialized in work similar to the type required for this project.
- C. Test Panels: Before full-scale application, test products to be used on test panels OR an inconspicuous location on the building as directed by the Construction Manager.
  - 1. Review manufacturer's Product Data to determine suitability of each product for each surface.
  - 2. Apply products using manufacturer-approved application methods, determining actual requirements for application.
  - 3. After 48 hours, review effectiveness of cleaning or treatment, compatibility with substrates, and ability to achieve desired results.
  - 4. Obtain approval by Architect and Owner of workmanship, color, and texture before proceeding with work.

5. Test Panels: Inconspicuous sections of actual construction.
  - a. Location and number as selected by Architect.
  - b. Size; 4 feet by 4 feet.
  - c. Repair unacceptable work to the satisfaction of the Architect and Owner.
- D. Pre-Installation Meeting: Hold a meeting prior to starting application, to review project conditions, protection requirements, manufacturer's installation instructions and manufacturer's warranty requirements. See Section 013300 for additional requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in time to avoid construction delays.
- B. Deliver and store products in manufacturer's original packaging with identification labels intact.
- C. Store products protected from weather and at temperature and humidity conditions recommended by manufacturer.

## 1.7 PROJECT CONDITIONS

- A. Do not apply products under conditions outside manufacturer's requirements, which include:
  1. Surfaces that are frozen; allow complete thawing prior to installation.
  2. Surface and air temperatures below 40 degrees F (4 degrees C).
  3. Surface and air temperatures above 95 degrees F (35 degrees C).
  4. When surface or air temperature is not expected to remain above 40 degrees F (4 degrees C) for at least 8 hours after application.
  5. Wind conditions that may blow materials onto surfaces not intended to be treated.
  6. Less than 24 hours after a rain.
  7. When rain is expected less than 6 hours after installation.

## 1.8 WARRANTY

- A. See Division 1 for additional requirements.
- B. Provide manufacturer's standard warranty for not less than two (2) years commencing on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
  1. Chemique, Inc., Moorestown, NJ
  2. "Safe n' Easy" products as manufactured by Dumond Chemical, NY, NY
  3. Diedrich Technologies, Inc., Milwaukee, WI
  4. PROSOCO, Inc., Lawrence, KS
- B. Requests for substitutions will be considered in accordance with provisions of Division 1.

### 2.2 RESTORATION CLEANERS

- A. Cleaner for Removing Mold, Mildew, and Atmosphere Stains:
  1. C-13 Limestone Cleaner/Restorer manufactured by Chemique, Inc.
  2. "Safe n' Easy" Limestone Cleaner as manufactured by Dumond Chemical, Inc.
  3. "Safe n' Easy" Ultimate Stone & Masonry Cleaner as manufactured by Dumond

- Chemical, Inc.
- 4. "707X Limestone Cleaner Pre-Rinse" & "707N Limestone Neutralizer After-Rinse" as manufactured by Diedrich Technologies, Inc.
- 5. "101 Masonry Restorer Super Concentrate" as manufactured by Diedrich Technologies, Inc.
- B. Cleaner for Mortar Smears on New Construction:
  - 1. "Enviro Klean® Safety Klean" as manufactured by PROSOCO, Inc.
- C. Cleaner for Old Brick Masonry:
  - 1. Sure Klean® Light Duty Restoration as manufactured by PROSOCO, Inc.
  - 2. Enviro Klean® EK Restoration Cleaner as manufactured by PROSOCO, Inc.
- D. Cleaner for Cast Stone:
  - 1. Enviro Klean® 2010 All Surface Cleaner as manufactured by PROSOCO, Inc.
- E. Cleaner for Limestone
  - 1. Sure Klean® 766 Limestone & Masonry Prewash as manufactured by PROSOCO, Inc.
  - 2. Sure Klean® Limestone & Masonry Afterwash as manufactured by PROSOCO, Inc.

## 2.3 PAINT, COATING AND GRAFFITI REMOVERS

- A. Stripper for Removing Multiple Layers of Coatings:
  - 1. "StripIt" Paint & Coating Remover as manufactured by Chemique, Inc.
- B. Stripper for Removing Silicone Water Repellents, Sealants, and Adhesive Residue:
  - 1. "StripIt" for Silane & Siloxane Removal as manufactured by Chemique, Inc.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrates are acceptable for product installation; do not begin until substrates meet manufacturer's requirements.
- B. Do not begin until test panels have been approved by Architect.

### 3.2 PREPARATION

- A. Protect adjacent surfaces not to be treated prior to beginning application.
- B. Contractor shall take necessary precautions to collect restoration wash from dripping onto lower surfaces and properly dispose of collected waste product in accordance with the manufacturer's recommendations. Coordinate with the CM.
- C. On surfaces to be coated or treated, remove dirt, dust, oil, grease, and other contaminants that would interfere with penetration or performance of products; where cleaners are required, use products recommended by manufacturer; rinse thoroughly and allow to dry completely.

### 3.3 REPAIR OF BRICK MASONRY

- A. Refer to Specification Section 040120.

### 3.4 CLEANING EXISTING MASONRY

- A. Clean all exposed surfaces of masonry using materials specified, so that resulting surfaces have a uniform appearance.
- B. When cleaning stains and tough dirt, test masonry for composition and select appropriate cleaner in accordance with manufacturer's instructions and recommendations; use cleaner and cleaning methods selected to minimize damage to surfaces and deterioration of appearance.
- C. Application: Mortar Smears on New Construction
  - 1. Working from bottom to top, use clean water to thoroughly prewet surface to be cleaned.
  - 2. Apply Safety Klean liberally using low-pressure spray (50 psi max), roller or densely filled (tampico) masonry washing brush. Do not apply with high-pressure spray. Do not atomize.
  - 3. Let the cleaning solution dwell 3-5 minutes. Reapply. Light scrubbing of the surface improves cleaning results especially where high pressure rinsing equipment is not available. Do not let cleaning solution "dry into" to the masonry. If solution starts to dry, reapply.
  - 4. Rinse with clean water from the bottom to the top, covering each section of the surface with a concentrated stream of water. To avoid streaking on vertical walls, take care to keep the wall below wet and rinsed free of cleaner and residues.
- D. Application: Old Brick Masonry – Stage 1 (Sure Klean® Light Duty Restoration)
  - 1. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for EK Restoration Cleaner. Do not dilute or alter.
  - 2. Working from bottom to top, prewet surface with fresh water.
  - 3. Apply cleaner using a brush or roller. Gentle scrubbing application will improve results.
  - 4. Leave the cleaning solution on the surface for 10 to 20 minutes. Heavy soiling or mineral deposits may require longer dwell times. Do not let cleaning solution "dry in" to the masonry. If drying occurs, lightly wet treated surfaces with fresh water, and reapply the cleaner, gently scrubbing.
  - 5. Working from bottom to top, rinse thoroughly with fresh water. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. See also "Equipment" section of the Product Data Sheet.
    - The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.
    - Older, more delicate masonry may require restricting water pressure to avoid damage. Always test first.
  - 6. Repeat steps 2-5 if necessary.



E. Application: Old Brick Masonry - Stage 2 (Enviro Klean® EK Restoration Cleaner)

1. If the use of the mild, light duty cleaner specified as part of Stage 1 do not work, utilize a more aggressive product as described herein.
2. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for EK Restoration Cleaner. Do not dilute or alter.
3. Working from bottom to top, prewet surface with fresh water.
4. Apply cleaner using a brush or roller. Gentle scrubbing application will improve results.
5. Leave the cleaning solution on the surface for 10 to 20 minutes. Heavy soiling or mineral deposits may require longer dwell times. Do not let cleaning solution "dry in" to the masonry. If drying occurs, lightly wet treated surfaces with fresh water, and reapply the cleaner, gently scrubbing.
6. Working from bottom to top, rinse thoroughly with fresh water. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. See also "Equipment" section of the Product Data Sheet.
  - The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.
  - Older, more delicate masonry may require restricting water pressure to avoid damage. Always test first.
7. Repeat steps 3-6 if necessary.

F. Cleanup

1. Clean tools and equipment using fresh water.

3.5 REPAIR OF STONE MASONRY

- A. Refer to Specification Section 040122 – Stone Restoration.

3.6 CLEANING EXISTING MASONRY

- A. Clean all exposed surfaces of masonry using materials specified, so that resulting surfaces have a uniform appearance.
- B. When cleaning stains and tough dirt, test masonry for composition and select appropriate
- C. Application: Cast Stone
1. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for 2010 All Surface Cleaner. Use in concentrate or dilute 2010 All Surface Cleaner concentrate with 1-10 parts water. Refer to Product Data Sheet for recommended dilution for intended use.
  2. Working from bottom to top, prewet the surface with clean water.

3. Apply the diluted cleaning solution to the masonry surface using a brush or low- pressure spray.
4. Let the cleaner stay on the surface 1-10 minutes, based on testing. Gently scrub heavily soiled areas.
5. Working from bottom to top, rinse the surface thoroughly with clean water. The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. See also "Equipment" section of the Product Data Sheet.
6. Repeat steps 2 - 5 if necessary.

D. Application: Limestone & Masonry Prewash Cleaning

1. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for 766 Limestone & Masonry Prewash. Use 766 Limestone & Masonry Prewash in concentrate or dilute with up to 3 parts water to 1 part concentrate. Use test area results to determine dilution for intended use.
2. Always prewet the surface with clean water, working from the bottom to the top.
3. Apply a heavy coating of 766 to the surface using a brush or roller.
4. Let the Prewash dwell on the surface 30 minutes to 2-hours. Longer dwell times may be required with lower temperatures. Do not let material dry on surface.
5. Working from the bottom of the work area to the top, pressure rinse, making sure to flush each portion of the masonry surface with concentrated water pressure.
6. The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. See also "Equipment" section of the Product Data Sheet.
7. If pressure water rinsing equipment is not available, reapply prewash and scrub vigorously with a stiff-bristled brush or scouring pad. Rinse thoroughly with fresh water.

E. Surface Neutralization

1. Treated surfaces must be neutralized by applying a solution of the proper Sure Klean® cleaning compound pursuant to the application instructions on the product label.
  - a. Brick, Terra Cotta, Sandstone and Other Non-calcareous Masonry: Immediately apply a solution of Sure Klean® Restoration Cleaner, following the instructions on the product label.

- b. Limestone, Cast Stone, Stucco & Cementitious Materials: Immediately apply a solution of Sure Klean® Limestone & Masonry Afterwash or Sure Klean® Limestone Restorer, following the instructions on the product label.

Note: The second wash down with the appropriate Sure Klean® cleaner is always necessary to completely restore the surface and to neutralize any 766 Limestone & Masonry Prewash, which may still be in the surface. The prewash penetrates into the masonry, and failure to remove the cleaner will result in an unsightly detergent residue. Application of Sure Klean® Limestone & Masonry Afterwash, Restoration Cleaner or Limestone Restorer ensures complete removal of 766 Limestone & Masonry Prewash.

F. Application: Limestone & Masonry Afterwash Cleaning

1. Before applying, read “Preparation” and “Safety Information” sections in the Manufacturer’s Product Data Sheet for Limestone & Masonry Afterwash. Dilute 1 part water to 1 part concentrate.
2. Use Limestone & Masonry Afterwash as a follow-up treatment to Sure Klean® 766 Limestone and Masonry Prewash and Enviro Klean® ReKlaim. Limestone & Masonry Afterwash works as part of these two-part cleaning systems to completely restore and neutralize masonry surfaces.
  - a. Immediately after rinsing 766 Limestone & Masonry Prewash or ReKlaim from masonry surface, apply the diluted Afterwash to the wet surface.
  - b. Let the Afterwash stay on the surface for three to five minutes.
  - c. Pressure rinse from the bottom of the treated area to the top. Make sure to cover each portion of the masonry surface with a concentrated stream of water. To avoid streaking, keep wall surfaces immediately below area being cleaned running wet and free of cleaner rundown and residues.
  - d. Using pH papers, pH pen or pH indicator solutions, check treated surfaces to ensure neutralization has been achieved. Repeat steps 1 through 3 above if needed until surface pH is 5.0 to 9.0.
  - e. Let neutralized surface dry thoroughly. Before applying new surface coatings, check the cleaned surface again using pH papers, pH pen or pH indicator solutions. Check that surface pH is neutral. Inadequate neutralization may cause surface discoloration or failure of new surface coatings.

G. Cleanup

1. Clean tools and equipment using fresh water.
2. Contractor shall collect and dispose of the afterwash mix in accordance with the manufacturer’s recommendations. Coordinate with the Owner and CM.

### 3.7 CLEANING AND PROTECTION

- A. At completion of work, remove protective coverings.

- B. If surfaces that should have been protected from damage by this work have been damaged, clean, repair or replace to the satisfaction of the Architect.
- C. Repair or replace damaged treated surfaces.
- D. Protect completed work from damage during construction.

END OF SECTION 040110

## SECTION 040120 – UNIT MASONRY RESTORATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes maintenance of unit masonry consisting of brick clay masonry restoration and cleaning as follows:
  - 1. Mortar Analysis
  - 2. Repairing unit masonry, including replacing units.
  - 3. Repointing joints.
  - 4. Preliminary cleaning, including removing plant growth and painted surfaces.
  - 5. Cleaning exposed unit masonry.

#### 1.3 UNIT PRICES

- A. Unit prices for clay masonry restoration and cleaning are specified in Division 01 Section "Unit Prices."
  - 1. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.
- B. Provide preconstruction testing as part of unit price.
- C. Remove and replace brick as part of exterior masonry repair / rebuilding.
- D. Clean brickwork, including preliminary and final cleaning, as part of masonry cleaning unit price.
- E. Repoint masonry as part of repointing masonry unit price.

#### 1.4 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi.
- B. Low-Pressure Spray: 100 to 400 psi, 4 to 6 gpm.
- C. Medium-Pressure Spray: 400 to 800 psi, 4 to 6 gpm.
- D. High-Pressure Spray: 800 to 1200 psi, 4 to 6 gpm.

- E. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Initial Selection for the following:
  - 1. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
    - a. Have each set contain a close color range of at least three samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
  - 2. Sealant Materials: See Division 07 Section "Joint Sealants."
  - 3. Include similar Samples of accessories involving color selection
- C. Samples for Verification: For the following:
  - 1. Each type of masonry unit to be used for replacing existing units. Include sets of Samples as necessary to show the full range of shape, color, and texture to be expected.
    - a. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
  - 2. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
    - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
  - 3. Each type of masonry patching compound in the form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
  - 4. Sealant Materials: See Division 07 Section "Joint Sealants."
  - 5. Accessories: Each type of anchor, accessory, and miscellaneous support.
- D. Qualification Data: For restoration specialists; including field supervisors and restoration workers, chemical-cleaner manufacturer and testing service.
- E. Quality-Control Program.
- F. Restoration Program
- G. Cleaning Program

## 1.6 QUALITY ASSURANCE

- A. Restoration Specialist Qualifications: Engage an experienced stone restoration and cleaning firm to perform work of this Section. Firm shall have completed (5) projects similar in material, design, and extent to that indicated for this Project with at least a (10) record of successful in-service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
  - 1. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
  - 2. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
- B. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- D. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.
- E. Restoration Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials and Project site.
  - 1. Include methods for keeping pointing mortar damp during curing period.
  - 2. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
- F. Cleaning and Repair Appearance Standard: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
  - 1. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.

2. Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- G. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
1. Brick Repair: Prepare sample areas for each type of brick indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
    - a. Brick Repair & Replacement: Two brick repairs for each type of brick indicated to be repaired and/or replaced.
  2. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
  3. Cleaning: Clean an area approximately 25 sq. ft. for each type of stone and surface condition.
    - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
    - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
  4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
- B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.



## 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
- B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
- C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.
- D. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
- E. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

## 1.9 COORDINATION

- A. Coordinate masonry restoration and cleaning with public circulation patterns at Project site. Some work is near public circulation patterns. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

## 1.10 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.
- B. Order sand and portland cement for pointing mortar immediately after approval of Samples. Take delivery of and store at Project site a sufficient quantity to complete Project.
- C. Perform masonry restoration work in the following sequence:
  - 1. Remove plant growth.
  - 2. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
  - 3. Remove paint.
  - 4. Clean masonry surfaces.
  - 5. Where water repellents, specified in Division 07, are to be used on or near masonry work, delay application of these chemicals until after pointing.
  - 6. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
  - 7. Repair masonry, including replacing existing masonry with new masonry materials.
  - 8. Rake out mortar from joints to be repointed.
  - 9. Point mortar and sealant joints.

10. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
  11. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
  12. Clean masonry surfaces.
- D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with "Repointing Masonry" Article.

## PART 2 - PRODUCTS

### 2.1 MASONRY MATERIALS

- A. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
1. Provide units with colors, color variation within units, surface texture, size, and shape to match existing brickwork and with physical properties as listed below:
    - a. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

### 2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
1. Color: Provide natural sand of color necessary to produce required mortar color.
  2. For pointing mortar, provide sand with rounded edges.
  3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- G. Water: Potable.

## 2.3 MANUFACTURED REPAIR MATERIALS

- A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cathedral Stone Products, Inc.; Jahn M100 Terra Cotta and Brick Repair Mortar.
    - b. Conproco Corporation; Mimic or Matrix.
    - c. Edison Coatings, Inc.; Custom System 45.
  - 2. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
  - 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
  - 4. Formulate patching compound used for patching brick in colors and textures to match each masonry unit being patched. Provide sufficient number of colors to enable matching the color, texture, and variation of each unit.

## 2.4 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Refer to Specification Section 040110 for appropriate cleaner.

## 2.5 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABR Products, Inc.; Rubber Mask.
    - b. Price Research, Ltd.; Price Mask.
    - c. PROSOCO; Sure Klean Strippable Masking.
- B. Sealant Materials:
  - 1. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants."
  - 2. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.

3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
- C. Joint-Sealant Backing:
1. Refer to Specification Section 079200.
- D. Setting Buttons: Resilient plastic buttons, non-staining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.
- E. Masking Tape: Non-staining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- F. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing the work involved.
  2. Little possibility of damaging exposed surfaces.
  3. Consistency of each application.
  4. Uniformity of the resulting overall appearance.
  5. Do not use products or tools that could do the following:
    - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
    - b. Leave a residue on surfaces.

## 2.6 MORTAR MIXES

- A. Mortar Analysis: General contractor to hire a conservator to perform a mortar analysis. A conservator regularly engaged in analyzing mortar mixes shall be hired to determine mortar compatibility and identify appropriate mortar selection. The following conservators are preapproved for this type of work:
1. J. Christopher Frey  
Keystone Preservation Group  
P.O. Box 831  
Doylestown, PA 18901  
Tel/Fax: 215-348-4919
  2. Jablonski Building Conservation  
40 West 27<sup>th</sup> street, Suite 1201  
New York, NY 10001  
Tel: 212-532-7775  
Fax: 212-532-2188  
[www.jbconservation.com](http://www.jbconservation.com)
  3. Richbrook Conservation  
P.O. Box 1061  
New York, NY 10025  
Tel: 646-315-5442

- B. Substitutions: If proposed equal is submitted, lab test to establish equivalent performance levels. Use an independent testing laboratory, as determined by the Specifier, and paid for by the submitting party.
- C. Contractor shall assume that a minimum of (8) mortar analyses will be required.

## 2.7 CHEMICAL CLEANING SOLUTIONS

- A. Refer to Specification Section 040110 for appropriate cleaner.
- B. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
  - 1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
- B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
  - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
  - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
  - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding masonry and other surfaces.
  - 1. Cover sills, ledges, and projections to protect from mortar droppings.
  - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.

3. Immediately remove mortar in contact with exposed masonry and other surfaces.
  4. Clean mortar splatters from scaffolding at end of each day.
- D. Remove downspouts adjacent to masonry and store during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning are complete.
1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- D. Remove in an undamaged condition as many whole bricks as possible.
1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
  2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
  3. Store brick for reuse. Store off ground, on skids, and protected from weather.
  4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- F. Replace removed damaged brick with other removed brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
- G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
1. Maintain joint width for replacement units to match existing joints.
  2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- H. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.

2. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

### 3.3 MASONRY UNIT PATCHING

- A. Patch the following masonry units unless another type of replacement or repair is indicated:

1. Units indicated to be patched.
2. Units with holes.
3. Units with chipped edges or corners.
4. Units with small areas of deep deterioration.

- B. Remove and replace existing patches unless otherwise indicated or approved by Architect.

- C. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
8. Keep each layer damp for 72 hours or until patching compound has set.

### 3.4 WIDENING JOINTS

- A. Do not widen a joint, except where indicated or approved by Architect.
- B. Location Guideline: Where an existing masonry unit abuts another or the joint is less than 1/8 inch, widen the joint for length indicated and to depth required for repointing after obtaining Architect's approval.
- C. Carefully perform widening by cutting, grinding, routing, or filing procedures demonstrated in an approved mockup.

- D. Widen joint to width equal to or less than predominant width of other joints on building. Make sides of widened joint uniform and parallel. Ensure that edges of units along widened joint are in alignment with joint edges at unaltered joints.

### 3.5 CLEANING MASONRY, GENERAL

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each masonry material and location.
  - 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
  - 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
    - a. Equip units with pressure gages.
  - 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
  - 4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
  - 5. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
  - 6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
- D. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- E. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
  - 1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- F. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

### 3.6 PRELIMINARY CLEANING



- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
  - 1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.

### 3.7 CLEANING BRICKWORK

- A. Detergent Cleaning:
  - 1. Wet masonry with cold water applied by low-pressure spray.
  - 2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
  - 3. Rinse with cold water applied by low pressure spray to remove detergent solution and soil.
- B. Mold, Mildew, and Algae Removal:
  - 1. Wet masonry with cold water applied by low-pressure spray.
  - 2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
  - 3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
  - 4. Rinse with cold water applied by low pressure spray to remove mold, mildew, and algae remover and soil.
- C. Nonacidic Gel Chemical Cleaning:
  - 1. Wet masonry with cold water applied by low-pressure spray.
  - 2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
  - 3. Let cleaner remain on surface for period indicated below:
    - a. As recommended by chemical-cleaner manufacturer.
    - b. As established by mockup.
  - 4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
  - 5. Rinse with cold water applied by low pressure spray to remove chemicals and soil.
- D. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
  - a. As recommended by chemical-cleaner manufacturer.
  - b. As established by mockup.
  - c. Two to three minutes.
3. Rinse with cold water applied by low pressure spray to remove chemicals and soil.

### 3.8 REPOINTING MASONRY

- A. Rake out and repoint joints to the following extent:
  1. All joints in areas indicated.
  2. Joints where mortar is missing or where they contain holes.
  3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
  4. Cracked joints where cracks are 1/16 inch or more in width and of any depth.
  5. Joints where they sound hollow when tapped by metal object.
  6. Joints where they are worn back 1/4 inch or more from surface.
  7. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
  8. Joints where they have been filled with substances other than mortar.
  9. Joints indicated as sealant-filled joints.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
  1. Remove mortar from joints to depth of 1-1/2 times joint width, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
  2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
  3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
    - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
    - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
  - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
  - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Pointing with Sealant:

1. After raking out, keep joints dry and free of mortar and debris.
2. Clean and prepare joint surfaces according to Division 07 Section "Joint Sealants." Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant according to Division 07 Section "Joint Sealants" and the following:
  - a. Install cylindrical sealant backing beneath the sealant, except where space is insufficient. There, install bond-breaker tape.
  - b. Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
  - c. Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
    - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
  - d. Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.

- e. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.

4. Cure sealant according to Division 07 Section "Joint Sealants."

- G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

### 3.9 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
  - 1. Do not use metal scrapers or brushes.
  - 2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent woodwork and other non-masonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

END OF SECTION 040120

## SECTION 040122 – STONE RESTORATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes maintenance of stone assemblies consisting of stone restoration and cleaning as follows:
  - 1. Mortar Analysis.
  - 2. Repointing joints.
  - 3. Cleaning exposed stone surfaces.
  - 4. For repairing limestone, sandstone and brownstone.
  - 5. Removing plant growth.
- B. Related Sections:
  - 1. Division 4 Section 040140 "Masonry Cleaning"
  - 2. Division 7 Section 079200 "Joint Sealants"

#### 1.3 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi (690 kPa).
- B. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- C. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- D. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- E. Stone Terminology: ASTM C 119.
- F. Face Bedding: Setting of stone with the natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- B. Shop Drawings: For the following:

1. Replacement stone units and their jointing, showing relation of existing to new units.
2. Partial replacement stone units (dutchmen).
3. Setting number of each new stone unit and its location on the structure in annotated plans and elevations.
4. Provisions for expansion joints or other sealant joints.
5. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
6. Replacement and repair anchors, including drilled-in pins. Include details of anchors within individual stone units, with locations of anchors and dimensions of holes and recesses in stone required for anchors, including direction and angle of holes for pins.

C. Samples for Initial Selection: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by 1/4 inch (6 mm) wide, set in aluminum or plastic channels.
  - a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching the cleaned stone when cured and dry.
  - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
2. Patching Compound: Prepare a sample of each type of repair listed below, using masonry removed from the building where designated by the Architect. Prepare, install, and finish each sample repair according to the specifications. All samples must be applied to masonry. Prepare samples in an area where they will be exposed to the same conditions as will be present on the building during curing. Allow samples to cure at least three (3) days (or longer, if possible) before obtaining Architect's approval for color match. Mortar colors will continue to lighten as they cure and are exposed to the weather, so samples should be installed as far in advance as possible. A slightly darker color will give better long-term results. Samples should be viewed from a minimum distance of 12 feet.
3. Sealant Materials: See Division 7 Section "Joint Sealants."
4. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following:

1. Each type of sand used for pointing mortar; minimum 1 lb (0.5 kg) of each in plastic screw-top jars.
  - a. For blended sands, provide Samples of each component and blend.
  - b. Identify sources, both supplier and quarry, of each type of sand.

2. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by 1/4 inch (6 mm) wide, set in aluminum or plastic channels.
  - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
3. Each type of stone patching compound in form of briquettes, at least 3 inches (75 mm) long by 1-1/2 inches (38 mm) wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
4. Each type of adhesive.
5. Sealant Materials: See Division 7 Section "Joint Sealants."
6. Accessories: Each type of anchor, accessory, and miscellaneous support.
- E. Qualification Data: For restoration specialists; including field supervisors and restoration workers, chemical-cleaner manufacturer and testing service.
- F. Quality-Control Program.
- G. Restoration Program.
- H. Cleaning Program.

#### 1.5 QUALITY ASSURANCE

- A. Restoration Specialist Qualifications: Engage an experienced stone restoration and cleaning firm to perform work of this Section. Firm shall have completed (5) projects similar in material, design, and extent to that indicated for this Project with at least a (10) record of successful in-service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
  1. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
  2. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
- B. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. Source Limitations: Obtain each type of material for stone restoration (stone, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.

- D. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.
- E. Restoration Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials and Project site.
  - 1. Include methods for keeping pointing mortar damp during curing period.
  - 2. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
- F. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
  - 1. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
- G. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet (6 m) 50 feet (15 m) away by Architect. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- H. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
  - 1. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
    - a. Stone Plug Repair: Two stone plug repairs for each type of stone indicated to be plugged.
    - b. Crack Injection: Apply crack injection in 2 separate areas, each approximately 36 inches long.
    - c. Patching: Three small holes at least 1 inch in diameter.

Repointing: Rake out joints in 2 separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
  - 2. Cleaning: Clean an area approximately 25 sq. ft. for each type of stone and surface condition.



- a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
  - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
- 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- I. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to stone restoration and cleaning including, but not limited to, the following:
    - a. Construction Schedule: Verify availability of materials, Restoration Specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Materials, material application, sequencing, tolerances, and required clearances.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver stone units to Project site strapped together in suitable packs or pallets or in heavy-duty crates.
- B. Deliver each piece of granite with code mark or setting number on unexposed face, corresponding to Shop Drawings, using non-staining paint.
- C. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- F. Store lime putty covered with water in sealed containers.
- G. Store sand where grading and other required characteristics can be maintained, and contamination avoided.

#### 1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

- B. Repair stone units and repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for stone repair and mortar-joint pointing unless otherwise indicated:
  - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, repair materials, and existing stone to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
  - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
- D. Hot-Weather Requirements: Protect stone repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
- E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
- F. Clean stone surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.
- G. Apply stone consolidation treatment only when surface and air temperatures are between 50 and 90 deg F (10 and 32 deg C) and rain is not expected within 24 hours.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.
- B. Perform stone restoration work in the following sequence:
  - 1. Removal and salvage of existing stone.
  - 2. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
  - 3. Repair/removal of steel lintels.
  - 4. Clean stone surfaces.
  - 5. Reinstallation of existing salvaged stone.
  - 6. Rake out mortar from joints surrounding stone to be replaced and from joints adjacent to stone repairs along joints.
  - 7. Rake out mortar from joints to be repointed.
  - 8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

9. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
  10. Remove paint.
  11. Clean stone surfaces not removed.
- C. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in stone to comply with "Stone Patching" Article. Patch holes in mortar joints to comply with "Repointing Stonework" Article.

## PART 2 - PRODUCTS

### 2.1 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I gray where required for color matching of exposed mortar.
1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
1. Color: Provide natural sand or other sound stone of color necessary to produce required mortar color.
  2. For pointing mortar, provide sand with rounded edges.
  3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- G. Water: Potable.

### 2.2 MANUFACTURED REPAIR MATERIALS

- A. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cathedral Stone Products, Inc.; Jahn Restoration Mortars.
    - b. Conproco Corporation; Mimic.
    - c. Edison Coatings, Inc.; Custom System 45.

2. Use formulation that is vapor- and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.
  3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
  4. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of colors to enable matching each piece of stone.
- B. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cathedral Stone Products, Inc.; Jahn Injection Grout.
    - b. Conproco Corporation; Terra Cotta Finish.
    - c. Edison Coatings, Inc.; Pump-X 53-Series.

## 2.3 CLEANING MATERIALS

### A. Restoration Cleaners

1. Refer to Specification Section 040110.

## 2.4 ACCESSORY MATERIALS

### A. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and pins from Type 304 stainless steel.

1. Set using Jahn anchor setting mortar (M80).

### B. Sealant Materials:

1. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 7 Section "Joint Sealants."
2. Colors: Provide colors of exposed sealants to match colors of stonework adjoining installed sealant unless otherwise indicated.
3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.

### C. Joint-Sealant Backing:

1. Refer to Specification Section 07920 for additional information.

### D. Setting Buttons: Resilient plastic buttons, non-staining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.

- E. Masking Tape: Non-staining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely including adhesive.
- F. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 29 zinc-rich coating.
  - 1. Use coating requiring no better than [SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
  - 2. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
  - 1. Previous effectiveness in performing the work involved.
  - 2. Little possibility of damaging exposed surfaces.
  - 3. Consistency of each application.
  - 4. Uniformity of the resulting overall appearance.
  - 5. Do not use products or tools that could do the following:
    - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
    - b. Leave a residue on surfaces.

## 2.5 MORTAR MIXES

- A. Mortar Analysis: General contractor to hire a conservator to perform a mortar analysis. A conservator regularly engaged in analyzing mortar mixes shall be hired to determine mortar compatibility and identify appropriate mortar selection. The following conservators are preapproved for this type of work:
  - 1. J. Christoper Frey  
Keystone Preservation Group  
P.O. Box 831  
Doylestown, PA 18901  
Tel/Fax: 215-348-4919
  - 2. Jablonski Building Conservation  
40 West 27<sup>th</sup> street, Suite 1201  
New York, NY 10001  
Tel: 212-532-7775  
Fax: 212-532-2188  
[www.jbconservation.com](http://www.jbconservation.com)

3. Richbrook Conservation  
P.O. Box 1061  
New York, NY 10025  
Tel: 646-315-5442  
[www.richbrook.net](http://www.richbrook.net)

- B. Substitutions: If proposed equal is submitted, lab test to establish equivalent performance levels. Use an independent testing laboratory, as determined by the Specifier, and paid for by the submitting party.
- C. Contractor shall assume that a minimum of (4) mortar analyses will be required.

### PART 3 - EXECUTION

#### 3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
  - 1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
- B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
  - 3. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
  - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
  - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding stone and other surfaces.
  - 1. Cover sills, ledges, and projections to protect from mortar droppings.
  - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
  - 3. Immediately remove mortar in contact with exposed stone and other surfaces.

4. Clean mortar splatters from scaffolding at end of each day.

### 3.2 STONE REMOVAL AND REPLACEMENT

- A. At locations indicated, remove stone, salvage for it to be reused. Carefully remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.
- B. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.
- D. Remove in an undamaged condition as many whole stone units as possible.
  1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
  2. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.
  3. Store stone for reuse. Store off ground, on skids, and protected from weather.
  4. Deliver cleaned stone not required for reuse to Owner unless otherwise indicated.
- E. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- F. Install salvaged stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
  1. Maintain joint width for salvaged stone to match existing joints.
  2. Use setting buttons or shims to set stone accurately spaced with uniform joints.
- G. Set salvaged stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
  1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
  2. Rake out mortar used for laying stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing stone, and at same time as repointing of surrounding area.
  3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

### 3.3 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Inspect steel exposed during stone removal. Where Architect determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
  - 1. Remove paint, rust, and other contaminants according to [SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning", as applicable to meet paint manufacturer's recommended preparation.
  - 2. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify Architect before proceeding.

### 3.4 STONE PLUG REPAIR

- A. Remove cylindrical piece of damaged stone by core-drilling perpendicular to stone surface.
- B. Prepare a replacement plug by core-drilling replacement stone. Use a drill sized to produce a core that will fit into hole drilled in damaged stone with only minimum gap necessary for adhesive. Cut and install plug so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.
- C. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and plug, completely filling all crevices and voids.
- D. Apply plug while adhesive is still tacky and hold securely in place until adhesive has cured.
- E. Clean adhesive residue from exposed surfaces.

### 3.5 STONE PATCHING

- A. Patch the following stone units unless another type of replacement or repair is indicated:
  - 1. Units indicated to be patched.
  - 2. Units with holes.
  - 3. Units with chipped edges or corners.
  - 4. Units with small areas of deep deterioration.
  - 5. Spalled units with visible deterioration
- B. Remove and replace existing patches unless otherwise indicated or approved by Architect.



- C. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
- D. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.
- E. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
- F. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
- G. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
  - 1. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
  - 2. Build patch up 1/4 inch (6 mm) above surrounding stone and carve surface to match adjoining stone after patching compound has hardened.
- H. Keep each layer damp for 72 hours or until patching compound has set.
- I. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

### 3.6 CLEANING STONE, GENERAL

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each stone material and location.
  - 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
  - 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
    - a. Equip units with pressure gages.
  - 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
  - 4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.

5. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
  6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
  7. For steam application, use steam generator capable of delivering live steam at nozzle.
- C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging stone surfaces.
- D. Water Application Methods:
1. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
  2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- E. Steam Cleaning: Apply steam to stone surfaces at the very low pressures indicated for each type of stonework. Hold nozzle at least 6 inches (150 mm) from surface of stone and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- F. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- G. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- H. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

### 3.7 CLEANING STONework

- A. Two-Part Brownstone Chemical Cleaning:
1. Wet stone with cold water applied by low-pressure spray.

2. Apply alkaline prewash cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
3. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
4. Apply acidic afterwash cleaner to stone in two applications, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

### 3.8 REPOINTING STONework

- A. Rake out and repoint joints to the following extent:
  1. All joints in areas indicated.
  2. Joints where mortar is missing or where they contain holes.
  3. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.
  4. Cracked joints where cracks are 1/8 inch (3 mm) or more in width and of any depth.
  5. Joints where they sound hollow when tapped by metal object.
  6. Joints where they are worn back 1/4 inch (6 mm) or more from surface.
  7. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
  8. Joints where they have been filled with substances other than mortar.
  9. Joints indicated as sealant-filled joints.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
  1. Remove mortar from joints to depth of 2 times joint width, but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.
  2. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.

3. Do not spall edges of stone units or widen joints. Replace or patch damaged stone units as directed by Architect.
  - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
  - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
  1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
  2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
  3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to featheredge the mortar.
  4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
  5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
    - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
    - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
  6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

### 3.9 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.

1. Do not use metal scrapers or brushes.
  2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent woodwork and other nonstone surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

### 3.10 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- B. Notify Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect's Project representatives have had reasonable opportunity to make observations of work areas at lift device or scaffold location.

END OF SECTION 040122



## SECTION 042113 – BRICK MASONRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Clay face brick.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Cavity wall insulation.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete"
2. Section 047200 "Cast Stone Masonry"
3. Section 072100 "Building Insulation"
4. Section 040110 "Masonry Cleaning"

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Clay face brick
2. Stone trim.
3. Colored mortar.
4. Weep vents/cavity cell vents.

D. Samples for Verification: For each type and color of the following:

1. Clay face brick
2. Special brick shapes.
3. Stone trim.

4. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
5. Weep holes and cavity vents.
6. Accessories embedded in masonry.

### 1.3 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, batch numbers, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
  1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
    - d. For masonry units, include data and calculations establishing average net-area compressive strength of units.
  2. Cementitious materials. Include name of manufacturer, brand name, and type.
  3. Mortar admixtures.
  4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  5. Grout mixes. Include description of type and proportions of ingredients.
  6. Reinforcing bars.
  7. Joint reinforcement.
  8. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
  2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

### 1.4 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.



- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 1.
1. Build sample panels for each type of exterior unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
  2. Build sample panels facing south.
  3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
  4. Clean one-half of exposed faces of panels with masonry cleaner indicated.
  5. Protect approved sample panels from the elements with weather-resistant membrane.
  6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for each type of exposed exterior unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Additionally, provide mock-ups of locations listed in architectural drawings.
    - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
    - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 18-inch length of flashing left exposed to view (omit masonry above half of flashing).
    - d. Include metal studs, sheathing, vapor barrier, veneer anchors, flashing, preformed corners and end dams, cavity drainage material, and weep vents in exterior masonry-veneer wall mockup.
  2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
  3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
  4. Protect accepted mockups from the elements with weather-resistant membrane.
  5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS, GENERAL

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
  - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

### 2.3 BRICK MASONRY

- A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. General: Provide shapes indicated and as follows.
  - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Clay Face Brick: Facing brick complying with ASTM C 216
  - 1. Basis of Design Products
    - a. Brick Type A: Ragland Clay Products - Custom Mud Brick Blend as provided by Consolidated Brick, (860) 335-4905. Contact: Leona Bohjalian. Brick selected to match brick selected in previous masonry restoration projects.
      - 1) Custom Mud Brick Blend: Modular Tara, Clear Kolotone, and Cotton Row Bricks manufactured by Ragland Clay Products.
  - 2. Grade: SW
  - 3. Type: FBS
  - 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.

5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
  6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
  7. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
- D. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

## 2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cemex S.A.B. de C.V.
    - b. Essroc.
    - c. Holcim (US) Inc.
    - d. Lafarge North America Inc.
    - e. Lehigh Hanson; HeidelbergCement Group.
- E. Mortar Cement: ASTM C 1329/C 1329M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lafarge North America Inc.
    - b. Approved Equal
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Davis Colors.
    - b. Lanxess Corporation.
    - c. Solomon Colors, Inc.

- G. Mixes in first paragraph below allow better control of color than job-mixed colored mortar. If retaining, also retain paragraphs above that specify materials included in the mixes retained below.
- H. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  - 1. Colored Portland Cement-Lime Mix:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Essroc.
      - 2) Holcim (US) Inc.
      - 3) Lafarge North America Inc.
      - 4) Lehigh Hanson; HeidelbergCement Group.
  - 2. Colored Masonry Cement:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cemex S.A.B. de C.V.
      - 2) Essroc.
      - 3) Holcim (US) Inc.
      - 4) Lafarge North America Inc.
      - 5) Lehigh Hanson; HeidelbergCement Group.
  - 3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  - 4. Pigments shall not exceed 10 percent of portland cement by weight.
  - 5. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- I. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- J. Aggregate for Grout: ASTM C 404.
- K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation; Construction Systems.
    - b. Euclid Chemical Company (The); an RPM company.

- c. Grace Construction Products; W.R. Grace & Co. -- Conn.
- L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ACM Chemistries.
    - b. BASF Corporation; Construction Systems.
    - c. Euclid Chemical Company (The); an RPM company.
    - d. Grace Construction Products; W.R. Grace & Co. -- Conn.
- M. Water: Potable

## 2.5 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
- B. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

## 2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
  - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Adjustable Masonry-Veneer Anchors:
  - 1. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
  - 2. Veneer Anchor
    - a. Basis of Design: DW-10HS by Hohmann & Barnard, Inc.
  - 3. Veneer Anchor with Pronged Legs
    - a. Basis of Design: X-Seal Anchor by Hohmann & Barnard, Inc.
  - 4. Materials Conformance:
    - a. Wire (Carbon Steel): Prefabricated from cold-drawn steel wire conforming to ASTM A1064/A1064M.
      - 1) Tensile Strength – 80,000 p.s.i., Yield Point – 70,000 p.s.i. minimum.
      - 2) Zinc Coating: Hot-Dipped Galvanized after fabrication: ASTM A153/A153M-B (1.5 oz/ft<sup>2</sup>)
    - b. Wire (Stainless Steel): ASTM A580/A580M – AISI Type 304 or Type 312
    - c. Sheet Metal (Carbon Steel): ASTM A1008/A1008M
      - 1) Zinc Coating: Hot-Dip Galvanized ASTM A153/A153M Class B2 (1.5 oz/ft<sup>2</sup>). (Sheet metal ties and anchors galvanized after fabrication.
    - d. Sheet Metal (Stainless Steel): ASTM A666, ASTM A480/480M, and ASTM A240/A240M, AISI Type 304 or 316.

- e. X-Seal Tape: ASTM D751-95, ASTM D4533-91, ASTM G154-98, ASTM E96-B
- f. Leg Depth: 1 ½" to 2" (Or equal to thickness of wallboard + insulation)
- g. Thickness: 14 Gauge
- h. Vee-Byna Tie Diameter: 3/16"Ø
- i. Vee-Byna Tie Length: 4"
- j. X-Seal Tape: Adhesive backed 3" x 75' rolls

## 2.7 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:
  - 1. Asphalt – Coated Copper Flashing: 5-oz./sq. ft. (1.5 – kg/sq.m) copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
    - a. Products:
      - 1) Hohmann & Barnard, Inc.; H & B C – Coat Flashing C-FAB
      - 2) Sandell Manufacturing Co., Inc.; Coated Copper Flashing
      - 3) York Manufacturing, Inc.; Copperseal
- B. Single – Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing panes have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging mortar.
  - 1. Product: Subject to compliance with requirements, provide "Blok-Flash" by Advanced Building Products, Inc.
- C. Solder and Sealants for Sheet Metal Flashings:
  - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
  - 2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent lead.
  - 3. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashings and trim remain watertight.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Cavity Wall Drainage System:
  - a. Basis-of-Design Product: Mortar Net Solutions; TotalFlash unitized flashing and cavity drainage system or comparable product by one of the following:
    - 1) Advanced Building Products Inc.
    - 2) Hyload, Inc.
  - b. Flashing Membrane: Composite flashing product consisting of UV stable thermoplastic vinyl of an overall thickness of not less than 0.040 inch.
  - c. Termination Bars:
    - 1) Stainless Steel: 1.25" high x 16 gauge thick, pre-drilled holes 6" on-center, 100% recyclable

d. Drip Edges:

Material and finish per location as noted on architectural drawings.

- 1) Stainless Steel: 3.0" high x 28 gauge, 3/8" hemmed edge, 100% recyclable
- 2) Cold-rolled Copper: 3.0" high x 24 gauge, 3/8" hemmed edge, 100% recyclable
- 3) Kynar®-coated galvanized steel: 3.0" high x 24 gauge, 3/8" hemmed edge, 4 color choices (Almond, Tan, Gray, Terra-cotta)

e. Complete Flash™: TPO, or synthetic rubber/polypropylene blend

- 1) 14" High inside/outside Corner Boots
- 2) 14" High inside/outside Corner Boots

f. Metal Drip Edge Corners:

- 1) 14" High inside/outside Corner Boots
- 2) 14" High inside/outside Corner Boots

g. Accessories: Provide preformed corners, end dams, and materials produced by flashing manufacturer.

- 1) Basis-of-Design Product: Mortar Net Solutions; CompleteFlash.

h. Sealants:

- 1) Basis-of-Design Product: Mortar Net Solutions; BTL-1, Butyl.

F. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use a flexible flashing with a metal drip edge.

G. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

## 2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:



1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
    - a. Basis-of-Design Product: Mortar Net Solutions; CellVent or compatible product by one of the following:
      - 1) Advanced Building Products Inc.
      - 2) Heckmann Building Products, Inc.
      - 3) Wire-Bond.
  2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide Mortar Net Solutions; WeepVent or comparable product by one of the following:
      - 1) Advanced Building Products Inc.
      - 2) Keene Building Products.
      - 3) Wire-Bond.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Basis-of-Design Product: Mortar Net Solutions; Mortar Net with Insect Barrier or comparable product by one of the following:
    - a. Advanced Building Products Inc.
    - b. Heckmann Building Products, Inc.
    - c. Wire-Bond.

## 2.9 MASONRY CLEANERS

- A. Refer to Spec Section 040110 "Masonry Cleaning"

## 2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
- B. Mixing: Use mechanical batch mixer and comply with referenced ASTM standards.
- C. Mortar for Unit Masonry: ASTM C 270, Proportion Specification.
1. Limit cementitious materials to lime and portland cement.
  2. Masonry below grade and in contact with earth: Type M
  3. Reinforced masonry: Type S.
  4. Applications as follows: Type N.
    - a. Locations for which another mortar type has not been specifically indicated.

- D. Grout: ASTM C 476; provide consistency required at time of placement to fill completely all spaces indicated to be grouted.
  - 1. Use fine grout in spaces less than 2 inches in least horizontal dimension.
  - 2. Use coarse grout in spaces 2 inches or more in least horizontal dimension.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  - 2. Verify that foundations are within tolerances specified.
  - 3. Verify that reinforcing dowels are properly placed.
  - 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.3 TOLERANCES

- A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet 1/4 inch in 20 feet or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet 3/8 inch in 20 feet or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond as indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
  - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
  - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Through Penetration Firestopping Systems."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay brick as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
  - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Lay structural clay tile as follows:
  - 1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
  - 2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will

- be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.
- D. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.
  - E. Install clay flue liners to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
  - F. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
    1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
    2. Allow cleaned surfaces to dry before setting.
    3. Wet joint surfaces thoroughly before applying mortar.
    4. Rake out mortar joints for pointing with sealant.
  - G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
    1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.
  - H. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
  - I. Cut joints flush where indicated to receive cavity wall insulation and vapor barriers unless otherwise indicated.

### 3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with seismic masonry-veneer anchors to comply with the following requirements:
  1. Fasten anchors through sheathing to wall framing with metal fasteners of type indicated in Part 2. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections in masonry joints.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  4. Space anchors as indicated, but not more than 24 inches o.c. vertically and 16 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 8 inches of openings and at intervals, not exceeding 8 inches around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

### 3.7 MASONRY-CELL FILL

- A. Pour lightweight-aggregate fill into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

### 3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
  1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
  2. Build flanges of factory-fabricated, expansion-joint units into masonry.
  3. Build in compressible joint fillers where indicated.
  4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
  1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.9 LINTELS

- A. Steel Lintels:
  1. Install steel lintels where indicated on structural drawings.
- B. Concealed Brick Lintel System:
  1. Install Concealed Arched Spline Lintel System by Hohmann & Bardard where indicated on structural drawings. Hot-Dipped Galvanized or Stainless Steel.

### 3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal

- penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches with upper edge tucked under vapor barrier lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
  - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
  - D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
    - 1. Use specified weep/cavity vent products to form weep holes.
    - 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
    - 3. Space weep holes 24 inches o.c. unless otherwise indicated.
  - E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
  - H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for [mortar air content] [and] [compressive strength].
- Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

### 3.12 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

### 3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
  - 7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 8. Clean stone trim to comply with stone supplier's written instructions.



9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

#### 3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  1. Crush masonry waste to less than 4 inches in each dimension.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113



## SECTION 042200 – CONCRETE UNIT MASONRY

### PART 1- GENERAL

#### 1.1 SUMMARY

- A. This section includes the following:
  - 1. Concrete masonry units.
  - 2. Mortar and grout.
  - 3. Reinforcing steel.
  - 4. Control joint materials.
  - 5. Masonry joint reinforcement.
  - 6. Ties and anchors.
  - 7. Miscellaneous masonry accessories.
- B. Related Sections:
  - 1. Division 7 Section: "Flashing and sheet metal"
  - 2. Division 7 Section: "Joint sealants"

#### 1.2 REFERENCES

- A. TMS 602/ACI 530.1/ASCE 6 Specification for Masonry Structures

#### 1.3 SYSTEM DESCRIPTION

- A. Provide materials to achieve the net compressive strength of concrete unit masonry equal to or greater than 2000 psi f'm.

#### 1.4 SUBMITTALS

- A. Product Data: Submit published data from manufacturers of products and accessories specified, indicating compliance with requirements.
- B. Mix design and test reports for pre-blended mortar indicating types and proportions of materials according to proportion specification of ASTM C270.
- C. Mix design and test reports for conventional grout indicating types and proportions of materials according to proportion requirements of ASTM C476.

#### 1.5 QUALITY ASSURANCE

- A. Preconstruction Testing.
  - 1. Owner will select a qualified independent testing agency to perform preconstruction testing indicated below.
  - 2. The compressive strength of masonry shall be determined based on strength of the unit and type of mortar.
  - 3. Concrete Masonry Units: Test per ASTM C140.
  - 4. Sample Panels: Construct a panel for representation of completed masonry, joint tooling, design details, and workmanship.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means which will prevent mechanical damage and deterioration due to moisture, temperature changes, and contamination by other materials.
  - 1. Provide protection which will limit moisture absorption of concrete masonry units to the maximum percentage specified for Type I units at a relative humidity which is normal for the project site.
- B. Protect cementitious materials from precipitation and absorption of ground moisture.
- C. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

## 1.7 FIELD CONDITIONS

- A. Construction Protection: Cover tops of incomplete masonry elements with waterproof sheet material at end of each work day and when masonry work is not under way.
  - 1. Secure weather protection in place with weights or by use of temporary fasteners.
  - 2. Immediately remove mortar, soil, and other such materials from exposed masonry faces to prevent staining.
- B. Loading Protection: Do not apply uniform floor or roof loads for at least 12 hours, or concentrated loads for at least 3 days, after completion of masonry elements.
- C. Cold-weather procedures when ambient temperature falls below 40°F or the temperature of masonry units is below 40°F:
  - 1. Wet or frozen units shall not be laid.
  - 2. Implement cold weather construction procedures in accordance with TMS 602/ACI 530.1/ASCE 6 Article 1.8 C.
- D. Hot-weather procedures when ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
  - 1. Implement hot weather construction procedures in accordance with TMS 602/ACI 530.1/ASCE 6 Article 1.8 D.

## PART 2 - PRODUCTS

### 2.1 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units: ASTM C90, and as follows:
  - 1. Weight Classification: Medium weight unless otherwise indicated.
  - 2. Type I: Moisture controlled units.
  - 3. Size: Standard units with nominal face dimensions of 16 inches long and 8 inches high (15-5/8 by 7-5/8 actual), with nominal thicknesses as indicated on drawings.
  - 4. Exposed faces: Manufacturer's standard color and texture, except where special finish is indicated on the drawings.

- B. Special shapes: Provide special block types where required for corners, control joints, headers, lintels, and other special conditions, whether or not specifically indicated on the drawings as special.
- C. Outside corners: Square-edged units except where otherwise indicated.

## 2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150 Type 1.
  - 1. Type III may be substituted during cold-weather construction.
  - 2. Provide Portland cement of color required to produce approved mortar sample.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Aggregate for Mortar: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Pigments for Colored Mortar: Iron oxides and chromium oxides with demonstrated record of satisfactory performance in mortar mixes.
- F. Provide grout with a slump of 8 to 11 inches per TMS 602/ACI 530.1/ASCE 6 Article 2.6 B.
- G. Water: Potable.
- H. Accelerating Admixtures: Nonchloride type for cold weather mortar mixes, in proportion recommended by manufacturer.
- I. Air-entraining Admixtures: Not permitted.

## 2.3 REINFORCEMENT AND METAL ACCESSORIES

- A. Steel Reinforcing Bars: ASTM A615.
- B. Masonry Joint Reinforcement: ASTM A951 welded-wire units prefabricated into straight lengths of not less than 10 feet, with deformed continuous side rods and plain cross rods.
  - 1. Width: Approximately two inches less than nominal wall width, providing not less than 5/8 inch mortar coverage on exterior exposures and 1/2 inch elsewhere.
  - 2. Wire sizes:
    - a. Side rod diameter: 0.1875 inch.
    - b. Cross rod diameter: 0.1483 inch.
  - 3. Configuration:
    - a. Applications of single unit width: Truss design, diagonal cross rods at not more than 16 inches on center.
    - b. Corners: Prefabricated L- and T-shaped units.
- C. Anchors, ties, and accessories:
  - 1. Plate and bent-bar anchors: ASTM A36.
  - 2. Sheet-metal anchors and ties: ASTM A1008.
  - 3. Wire mesh ties: ASTM A185.
  - 4. Wire ties and anchors: ASTM A82.
  - 5. Headed anchor bolts: ASTM A307, Grade A.

- D. Coatings for corrosion protection. Unless otherwise required, protect carbon steel joint reinforcement, ties, and anchors from corrosion by galvanizing or epoxy coating in conformance with the following minimums:
  - 1. Mill galvanized coatings:
    - a. Joint reinforcement: ASTM A641 (0.1 oz/ft<sup>2</sup>)
    - b. Sheet metal anchors and ties: ASTM A653 Coating Designation G60.
  - 2. Hot-dipped galvanized coatings:
    - a. Joint reinforcement, wire ties, and wire anchors: ASTM A153 (1.50 oz/ft<sup>2</sup>).
    - b. Sheet metal anchors and ties: ASTM A153 Class B.

## 2.4 MISCELLANEOUS MASONRY ACCESSORIES

- A. Rubber Preformed Control-Joint Gaskets: per ASTM D2000, Designation M2AA-805.
- B. PVC Preformed Control-Joint Gaskets: per ASTM D2287, Type PVC 654-4.
- C. Bond Breaker Strips: ASTM D 226, Type I; No. 15 asphalt felt.
- D. Sealant and Backer Rod: As specified in Division 7

## 2.5 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures unless indicated as acceptable in the contract documents.
  - 1. Do not use calcium chloride in mortar or grout mixture.
- B. Mixing: Use mechanical batch mixer and comply with referenced ASTM standards.
- C. Mortar for Unit Masonry: ASTM C 270, Proportion Specification.
  - 1. Limit cementitious materials to lime and Portland cement.
  - 2. Masonry below grade and in contact with earth: Type M.
  - 3. Reinforced masonry and exterior above grade walls: Type S.
  - 4. Applications as follows: Type N.
    - a. Interior walls.
    - b. Locations for which another mortar type has not been specifically indicated.
- D. Grout: ASTM C 476; provide consistency required at time of placement to fill completely all spaces indicated to be grouted. Grout shall be either fine or coarse depending on space to be grouted. Minimum grout strength shall be 2500 psi at 28 days as measured by ASTM C1019 "Standard Method of Sampling and Testing Grout." Slump shall be a minimum of 8-inches as measured by slump cone test. Higher slump shall be provided for masonry units with high IRA (initial rate of absorption) and smaller grout spaces.

## PART 3 - EXECUTION

### 3.3 PREPARATION

- A. Clean reinforcement and shanks of anchor bolts by removing mud, oil, or other materials that will adversely affect bond to mortar or grout.

- B. Reinforcement with rust and/or mill scale is acceptable provided attributes of a cleaned sample are in accordance with the applicable ASTM specification.
- C. Prior to laying masonry, remove laitance, loose aggregate, and any other material that would prevent mortar from bonding to the foundation.
- D. Do not wet units prior to laying.
- E. Cut units as required to fit; use motor-driven masonry saw. Install cut units with cut surfaces concealed as much as possible.

#### 3.4 INSTALLATION

- A. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures.
- B. Mix units from several pallets or cubes as they are placed.
- C. Comply with construction tolerances in TMS 602/ACI 530.1/ASCE 6, Article 3.3F.
- D. Construct grout spaces free of mortar dropping, debris, and any material deleterious to grouting.
- E. All masonry shall be laid true, level, plumb, and in accordance with the drawings.
- F. Ensure all vertical cells to be grouted are aligned and unobstructed openings for grout are provided.
- G. Masonry shall be laid in running bond unless otherwise indicated in the drawings.
- H. Brace masonry during construction to assure stability. Design, provide, and install bracing.

#### 3.5 MORTAR BEDDING AND JOINTING

- A. Place mortar in accordance with TMS 602/ACI 530.1/ASCE 6 Article 3.3 B.
- B. Initial bed joint shall not be less than 1/4 inch nor more than 3/4 inch.
- C. All head and bed joints, except as in 3.4 B., shall be a nominal 3/8 in. thick, unless otherwise required.
- D. Lay hollow units with head and bed joints filled with mortar for the thickness of the face shell.
- E. Remove mortar protrusions extending 1/2 in. or more into cells to be grouted.
- F. Fully mortar webs in all courses of piers, columns and pilasters, in the starting course on foundations, and when necessary to confine grout.
- G. All mortar joints on exposed walls shall be concave, unless otherwise indicated, and struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.
- H. Remove and re-lay in fresh mortar any unit that has been disturbed to the extent the initial bond is broken.

- I. Unless other conditions are specifically detailed, solidly grout cores for at least 24 inches below bearing plates, lintels, and similar features and conditions.

### 3.6 EMBEDDED ITEMS AND ACCESSORIES

- A. Construct control joints as detailed in the drawings as masonry progresses.
  - 1. Install preformed control-joint gaskets designed to fit standard block.
- B. Construct chases as masonry units are laid.
- C. Install pipes and conduits passing horizontally through masonry as indicated.
- D. Install steel lintels at all openings.
  - 1. Bearing: Provide not less than 8 inches of bearing at each jamb. Grout cells solid under bearing for full height of opening (16 inches wide).
  - 2. Reinforcement: At masonry openings greater than one foot in width, install horizontal joint reinforcement immediately below sill. Except at control joints, install opening reinforcement to extend not less than 24 inches beyond jamb on each side.
- E. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories as required.

### 3.7 REINFORCING STEEL, WALL TIES, AND ANCHORS

- A. Install reinforcing steel, wall ties, and anchors in accordance with TMS 602/ACI 530.1/ASCE 6 Article 3.4
- B. Place reinforcement as detailed on the drawings.
  - 1. Support and fasten reinforcement at intervals not exceed 72" to prevent displacement beyond specified tolerances during construction and grouting operations.
  - 2. Maintain clear distances between reinforcement and any interior face of masonry unit or formed surface, but not less than 1/4 in. for fine grout, or 1/2 in. for coarse grout.
  - 3. Completely embed reinforcing bars in grout.
  - 4. Provide lapped splices of 48 bar diameters minimum. Provide lap-joint tie for each splice
  - 5. Embed joint reinforcement with minimum 5/8 inch cover to faces exposed to weather or earth, and 1/2 inch elsewhere.
  - 6. Provide minimum 12-in. lap splices and ensure that all ends of longitudinal wires are embedded in mortar at laps.
  - 7. Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1 in. horizontally for every 6 in. of vertical height.
- C. Install wall ties as detailed on the drawings and in accordance with TMS 602/ACI 530.1/ASCE 6 Article 3.4 C. Anchor masonry to structural framework at points of adjacency, and as follows:
  - 1. Maintain open space of 1 inch or more between face of framing member and masonry elements or as shown on the drawings.
  - 2. Fasten anchors to structure and embed in mortar joints as masonry is laid.



3. Space anchors at maximum of 24 inches on center horizontally and 24 inches on center vertically.

### 3.8 GROUTING

- A. Comply with grout placement requirements in TMS 602/ACI 530.1/ASCE 6 Article 3.5.
- B. Place grout within 1 1/2 hr from introducing water in the mixture and prior to initial set.
- C. Grout pour height: do not exceed maximum grout pour height as given in TMS 602/ACI 530.1/ASCE 6 Table 7, or as otherwise specified.
- D. Grout lift height: Place grout in lifts not to exceed 60 inches.
- E. Grout consolidation: Consolidate grout pours by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

### 3.9 CONCEALED MASONRY FLASHING

- A. General: Install flashing at all conditions such as lintels and shelf angles, where the downward flow of water within the masonry will be interrupted, so that such water will be diverted to the exterior. Extend flashing full width at such obstructions and at least 4 inches into adjoining masonry and turn up to form watertight pan or provide pre-fabricated end dam. Remove or cover protrusions or sharp edges on substrates which could puncture flashings. Place flashings on sloped mortar bed; seal lapped ends and penetrations of flashing before covering with mortar.
  1. Extend metal flashings through exterior face of masonry and turn down to form drip.
  2. Extend fabric or laminated flashings to within 1/4 inch of exterior face of masonry.
- B. Head and Sills: Turn up ends of flashing at least 2 inches at heads and sills to form a pan, and seal joints.
- C. Sealing: Seal all joints in flashing to assure watertight integrity.
  1. Lap end joints on non-deformed metal flashings at least 4 inches; seal laps with elastic sealant or mastic.
  2. Lap end joints of flexible flashings at least 4 inches; seal in accordance with manufacturer's instructions.
- D. Weep Holes: Provide weep holes in head joints of the first course of masonry immediately above concealed flashings. Space at intervals of 24 inches on center.
- E. Reglets and Other Accessories: Install to receive flashing where indicated.

### 3.10 PARGING

- A. Mortar: Parge in two coats, using Type S or Type N mortar, to total thickness of not less than 1/2 inch.
- B. Finishing: Trowel to dense, hard surface.
- C. Curing: Damp-cure for at least 24 hours.

### 3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing agency will report inspection results promptly and in writing to Contractor and Architect
- C. Remove and replace work that does not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.12 POINTING AND CLEANING

- A. Point and tool holes in mortar joints to produce a uniform, tight joint.
- B. During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs.
  - 1. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.
  - 2. For burnished, glazed, or pre-finished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry surfaces of stains, efflorescence, mortar or grout droppings, and debris.
  - 1. Use appropriate masonry cleaner as tested on a sample panel, strictly following manufacturer's recommendations.
  - 2. Do not use acid based cleaning solutions.
- D. At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site.
- E. Sprayed-on water repellent shall be applied after masonry units are cleaned and thoroughly dry in strict accordance with manufacturer's instructions.

END OF SECTION 042200

## SECTION 047200 – CAST STONE MASONRY

### PART 1 - GENERAL

#### 1.1. SECTION INCLUDES - Architectural Cast Stone.

- A. Scope - All labor, materials and equipment to provide the Cast Stone shown on architectural drawings and as described in this specification.
  - 1. Manufacturer shall furnish Cast Stone covered by this specification.
  - 2. Installing contractor shall unload, store, furnish all anchors, set, patch, clean and seal (optional) the Cast Stone as required.

#### 1.2. RELATED SECTIONS

- A. Section – 042113 Brick Masonry
- B. Section – 042200 Concrete Unit Masonry
- C. Section – 079200 – Joint Sealants

#### 1.3. REFERENCES

- A. ACI 318 – Building Code Requirements for Reinforced Concrete.
- B. ASTM A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- C. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete.
- D. ASTM C 33 – Standard Specification for Concrete Aggregates.
- E. ASTM C 150 - Standard Specification for Portland Cement.
- F. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
- G. ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units
- H. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.
- I. ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- J. ASTM C 979 - Standard Specification for Coloring Pigments for Integrally Pigmented Concrete.
- K. ASTM C 1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.
- L. ASTM C 1195 - Standard Test Method for Absorption of Architectural Cast Stone.
- M. ASTM C 1364 - Standard Specification for Architectural Cast Stone.

- N. ASTM D 2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- O. Cast Stone Institute Technical Manual (Current Edition)

#### 1.4. DEFINITIONS

- A. Cast Stone - a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
  - 1. Dry Cast Concrete Products – manufactured from zero slump concrete.
    - a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero- slump concrete against a rigid mold until it is densely compacted.
    - b. Machine casting method: manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.

#### 1.5. SUBMITTAL PROCEDURES

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.
- C. Test results: Submit manufacturers test results of Cast Stone previously made by the manufacturer.
- D. Custom Package Shop Drawings: Submit manufacturer's shop drawings including profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of components, and their locations in project as indicated on the drawings.
- E. Standard Package Shop Tickets: Submit manufacturer's shop tickets including profiles, cross sections, modular unit lengths, reinforcement, exposed faces, and annotation of components proposed for use in project according to cross sections as indicated on the drawings.
- F. *Signature Series*™ Package Catalog Cuts: Submit manufacturer's catalog cuts showing page and part numbers of units proposed for use in project.

#### 1.6. QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.
  - 2. Manufacturer shall submit a written list of projects similar in scope and at least five (5) years of age, along with owner, architect and contractor references.
- B. Standards: Comply with the requirements of the Cast Stone Institute Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.
- C. Mock-ups: Provide mock-ups of locations listed in architectural drawings. Provide full size unit(s) for use in construction of sample wall. The approved mock-up shall become the standard for appearance and workmanship for the project.

## PART 2 - PRODUCTS

### 2.1. MANUFACTURER

- A. Basis of design Manufacturer: Corinthian Cast Stone Inc. 115 Wyandanch Ave, Wyandanch NY 11798. Phone 860-355-4905 Fax 860-633-0099 E-Mail [lbohjalian@consolidatedbrick.com](mailto:lbohjalian@consolidatedbrick.com) Web – [www.CorinthianCastStone.com](http://www.CorinthianCastStone.com)

### 2.2. ARCHITECTURAL CAST STONE

- A. Comply with ASTM C 1364
- B. Physical properties: Provide the following:
  - 1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
  - 2. Absorption - ASTM C 1195: 6% maximum by the cold water method.
  - 3. Air entrainment is not required for VDT products.
  - 4. Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
  - 5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.
- C. Job site testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 m<sup>3</sup>) delivered to the job site.
  - 1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
  - 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
  - 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

### 2.3. RAW MATERIALS

- A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the VDT casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
  - 1. ASTM C 260 for air-entraining admixtures.
  - 2. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
  - 3. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
- F. Water – Potable

- G. Reinforcing bars:
  - 1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).
  - 2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.
- H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless-steel Type 302 or 304.

#### 2.4. COLOR AND FINISH

- A. Match sample on file in architect's office – match existing
- B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. and the density of such voids shall be less than 3 occurrences per any 1 in.<sup>2</sup> and not obvious under direct daylight illumination at a 5 ft distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft distance.
  - 1. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
    - a. Total color difference – not greater than 6 units.
    - b. Total hue difference – not greater than 2 units.
- D. Minor chipping resulting from shipment and delivery is not grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft distance.
- E. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- F. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

#### 2.5. REINFORCING

- A. Reinforce the units as required by the drawings and for safe handling and structural stress.
- B. Minimum reinforcing shall be 0.25 percent of the cross-section area.
- C. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 in. of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- D. Panels, soffits and similar stones greater than 24 in. in one direction shall be reinforced in that direction. Units less than 24 in. in both their length and width dimension shall be non-reinforced unless otherwise specified.

#### 2.6. CURING

- A. Cure units in a warm curing chamber approximately 100°F at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70°F for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F or 5 days @ 70°F) prior to shipping. Form cured

units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

## 2.7. MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than  $\pm 1/8$  in. from approved dimensions.
- B. Length of units shall not deviate by more than length/ 360 or  $\pm 1/8$  in., whichever is greater, not to exceed  $\pm 1/4$  in..
  - 1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units shall not exceed length/ 360 or  $\pm 1/8$  in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in. (3 mm), on unformed sides of unit, 3/8 in. maximum deviation.

## 2.8. PRODUCTION QUALITY CONTROL

- A. Testing.
  - 1. Test compressive strength and absorption from specimens selected at random from plant production.
  - 2. Samples shall be taken and tested from every 500 cubic feet of product produced.
  - 3. Perform tests in accordance ASTM C 1194 and C 1195.
  - 4. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.

## 2.9. DELIVERY, STORAGE AND HANDLING

- A. Mark production units with the identification marks as shown on the shop drawings.
- B. Package units and protect them from staining or damage during shipping and storage.
- C. Provide an itemized list of products to support the bill of lading.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units. Notify Architect if construction is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

### 3.2. SETTING TOLERANCES

- A. Installation Tolerances: Comply with requirements of Cast Stone Institute Technical Manual.
  - 1. Variation from Plumb: Do not exceed 1/8 inch in 5 feet 1/4 inch in 20 feet or more.
  - 2. Variation from Level: Do not exceed 1/8 inch in 5 feet 1/4 inch in 20 feet, or 3/8 inch

maximum.

3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch or 1/4 of nominal joint width, whichever is greater.
4. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/8-inch difference between planes of adjacent components or adjacent surfaces indicated to be flush with components.

### 3.3. JOINTING

#### A. Joint size:

1. At stone/brick joints 3/8 in.
2. At stone/stone joints in vertical position 1/4 in. (3/8 in.).
3. Stone/stone joints exposed on top 3/8 in.

#### B. Joint materials:

1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints full width mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5. Leave head joints in copings and projecting components open for sealant.

#### C. Location of joints:

1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

### 3.4. SETTING

- A. Drench Cast Stone components with clear, running water immediately before installation.
- B. Do not use pry bars or other equipment in a manner that could damage Cast Stone components.
- C. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- D. Set Cast Stone components in a full bed of mortar, unless otherwise indicated on the drawings.
- E. Fill vertical joints with mortar.
- F. Make joints 3/8 inch, unless otherwise indicated on the drawings.
- G. Leave head joints in copings and similar components open for sealant.
- H. Rake mortar joints 3/4 inch for pointing. Sponge face of each stone to remove excess mortar.
- I. Tuck point joints to a slight concave profile.

### 3.5. JOINT PROTECTION

- A. Comply with requirements of Section 07 92 00.
- B. Prime end of units, insert properly sized backing rod and install required sealant.



3.6. REPAIR AND CLEANING

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

3.7. INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36.
- B. Do not field apply water repellant until repair, cleaning, inspection and acceptance is completed.

3.8 WATER REPELLANT

- A. Apply silane or siloxane water repellant for weatherproofing Cast Stone in accordance with manufacturer's instructions.
- B. Apply water repellant after pointing, patching, cleaning, and inspection are completed

END OF SECTION 047200



## SECTION 051200 – STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This section includes the following:
  - 1. Fabrication and erection of structural steel framing members, support members, bracing members and connections.
  - 2. Base plates, leveling plates, anchor bolts, leveling nuts, shear stud connectors, deformed bars welded to structural steel, and bolts.
  - 3. Grouting under base plates.
  - 4. Shop painting
- B. Products furnished but not installed under this section:
  - 1. Steel anchorages cast in concrete.
  - 2. Steel anchorages embedded in masonry.
- C. Related Sections:
  - 1. Division 05 Section "Steel Decking".

#### 1.2 REFERENCES

- A. General:
  - 1. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the work. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
- B. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code
  - 2. AWS D1.8 -Structural Welding Code -Seismic Supplement
- C. American Institute of Steel Construction (AISC):
  - 1. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges
  - 2. AISC 340 - Seismic Provisions for Structural Steel Buildings
  - 3. AISC 360 - Specification for Structural Steel Buildings
  - 4. AISC - Steel Construction Manual
  - 5. RCSC -Research Council on Structural Connections "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts

#### 1.3 DEFINITIONS

- A. Unless otherwise specifically approved in writing, furnish exact sections, weights, and kinds of material specified, using details and dimensions shown.
- B. Not all connections are detailed; similar details apply to similar conditions, unless otherwise indicated. Contact the engineer promptly to verify design of members or connections in any situation where design requirements are unclear.

#### 1.4 SUBMITTALS

- A. Shop drawings for structural steel fabrications shall be submitted for review prior to fabrication, including:
  - 1. Complete fabrication and erection plans and procedures giving full information on aspects of the erection which will affect alignment, plumb and dimensional accuracy of the structure.
  - 2. Connections including size and spacing of bolts and welds.
  - 3. Indicate profiles, sizes, spacing, and locations of structural members, openings, camber and attachments. Indicate welded connections with AWS welding symbols. Indicate net weld lengths. Details of welding materials, equipment, sequence and technique to be used.
  - 4. The contractor shall survey, review and confirm existing conditions prior to developing shop drawings.
  - 5. The fabricator is responsible for the adequacy of any connections designed by the fabricator to performance standards established in the contract documents. Approval of shop drawings does not relieve the fabricator of this responsibility.
  - 6. No portion of the contract drawings shall be reproduced for use as shop drawings.
  - 7. Electronic drawing files of the contract documents will not be provided to the contractor for use in shop drawing preparation for any trade.
- B. Manufacturer's Certificate: Submit certification that manufactured products (including bolts, nuts and washers) meet or exceed specified requirements.
- C. Product data: Submit certification that manufactured products meet or exceed specified requirements.
  - 1. Weld filler material including filler metal Charpy V-Notch test values, electrodes, fluxes and shield gases.
  - 2. Prime paint.
  - 3. Welded studs.
- D. Mill Test Reports: Submit mill test reports indicating structural strength, destructive and nondestructive test analysis and chemical analyses from each heat of steel used in the work.

#### 1.5 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC specifications.
- B. Welders shall be qualified in accordance with AWS D1.1 for each process, position and joint configuration.
- C. Survey anchor bolts for location and elevation prior to casting concrete.
- D. The design of connections not detailed on the Drawings shall be under the direct supervision of a Structural Engineer experienced in design of this work.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Shipping: Deliver steel in timely fashion, to permit the most efficient and economical flow or work. Deliver steel members properly marked for field assembly and erection.

1. Deliver anchor bolts, washers, and other anchorage devices to be built into other work in time to avoid delays and permit their proper installation.
- B. Storage: Protect steel and other materials of this section from damage and corrosion. If temporary storage at the project site is required, keep steel members off the ground, using platforms or pallets, in a location easily accessible for inspection

## PART 2 - PRODUCTS

### 3.1 MATERIALS

- A. Structural Steel Members: ASTM A992
- B. Plate, bars and channels: ASTM A36 unless otherwise noted on the drawings.
- C. Structural Tubing: ASTM A500, Grade B
- D. Pipe: ASTM A53, Grade B
- E. Shear Stud Connectors: ASTM A108. Connectors shall be free of defects, cracks or bursts deeper than half the thickness from the periphery of the head to the shaft. After welding, studs will be the length shown on the drawings.
- F. Bolts and Nuts: Bolts in structural steel connections shall be ASTM A325 unless designated as A490 on the drawings. Nuts shall be ASTM A563 Grade C or DH. Bolts conforming ASTM A307 and nuts conforming to ASTM A563 may be used in stair, handrail, miscellaneous steel and timber connections.
- G. Direct Tension Indicators: ASTM F959
- H. Tension Control Structural Bolts: ASTM F1852 or ASTM F2280
- I. Washers shall be flat and either circular, square or rectangular conforming to ASTM F436 Type 1. The finish of washers is to match the nut. A325 bolts shall have washers under the head and A490 bolts shall have hardened washers under the head and the nut.
- J. Anchor Bolts: ASTM F1554 36 ksi yield strength, unless otherwise designated on the drawings.
- K. Welding Materials: Filler metals shall conform to Table 4.1 of AWS D1.1. Electrodes and equipment settings shall be as recommended by the filler metal manufacturer for the position, thickness and conditions of use. electrodes and filler metal shall be low hydrogen types.
- L. Grout: ASTM C1107, Grade B non-shrink, non-metallic prepackaged grout requiring only the addition of water.
- M. Shop and Touch-Up Primer: Fast-curing, lead and chromate-free, VOC-compliant, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664, or equivalent.

### 3.2 CONNECTIONS

- A. Unless otherwise noted on the drawings, shop connections shall be welded and field connections shall be bolted. Weld only in accordance with approved welding procedures.

- B. Unless otherwise noted on the drawings, bolted connections shall be 3/4-inch diameter A325-N; connections shall have a minimum of two bolts. Shoulder bolts with hex nut and lock washers shall be used in slotted connections with the washer covering the slot in positions.
- C. Unless connections are detailed on the drawings, the contractor is responsible for the design of connections.
- D. All elements of a connection shall be designed to resist the loads and moments shown on the drawings; if the reaction or load is not shown on the drawings, connections are to be designed as follows:
  - 1. Beam connections are to be designed to resist one half the allowable load for the appropriate span given in the Tables 3-6 through 3-9 in the AISC Manual of Steel Construction.
  - 2. Composite Beam connections are to be designed to resist three quarters of the allowable load for the appropriate span given in the Tables 3-6 through 3-9 in the AISC Manual of Steel Construction.
  - 3. Beam connections shall be in accordance with the AISC Manual of Steel Construction. The minimum connection angle length will be half the depth of the beam depth.
  - 4. Oversize holes for anchor bolts may be used with field welded washer plates.

### 3.3 FABRICATION

- A. Fabricate structural steel in accordance with the applicable provisions of the AISC Specifications for Structural Steel Buildings. Where practical, fabricate and assemble in the shop.
- B. Obtain field measurements necessary for steel fabrication.
- C. Perform high strength shop bolting in accordance with the appropriate ASTM specification. Complete high strength shop bolting before welding.
- D. Where milling is indicated on the drawings, the contact surfaces shall be machined true to obtain full and complete contact.
- E. Shear studs shall not be installed in the shop.

### 3.4 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP-2
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, in contact with concrete, within 3 inches of field welds, or on the faying surface of high strength bolted friction connections.
- C. Galvanize structural steel members indicated on the drawings as galvanized in accordance with ASTM A123 and A385 after fabrication. Prepare galvanized surfaces to be painted in accordance with ASTM D2092 and shop coat with a compatible primer. Repair damaged galvanizing in accordance with ASTM A780.

### 3.5 SHOP QUALITY CONTROL

- A. Shop bolted connections: Comply with testing and verification procedures in AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
- B. Shop welded connections: Inspect and test shop-fabricated welds as follows:
  - 1. Visually inspect all welds.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation indicates contractor accepts that existing conditions meet the requirements for installation.

### 3.2 PREPARATION

- A. Provide anchor bolts and other items embedded in concrete.
- B. Furnish and install temporary supports and internal braces necessary to support structural steel during erection. Temporary supports and braces shall be adequate for anticipated wind, seismic, equipment and erection loads. Remove temporary shoring after the steel erection is complete.
- C. After completion of welds, remove weld tabs (spillage dams) in accordance with AWS D1.1 provisions for dynamically loaded structures. After completion of full penetration groove welds, remove backing bars in accordance with AWS D1.1 provisions for dynamically loaded structures, inspect the weld and reinforce the groove weld with a fillet weld.

### 3.3 ERECTION

- A. Erect structural steel in accordance with the AISC Specifications for Structural Steel Buildings.
- B. Perform high strength bolting in accordance with the appropriate ASTM specification. Complete high strength bolting before field welding.
- C. Do not field cut or alter structural members without approval of the engineer.
- D. Column bases and bearing plates:
  - 1. Clean concrete bearing surfaces from bond-reducing materials, and roughen if necessary to improve bond to surfaces.
  - 2. Clean the bottom surface of base plate.
  - 3. Set base plate on wedges or other adjustable devices.
  - 4. After the base plate has been positioned and plumbed, tighten the anchor bolts. Pack grout solidly between the bearing surfaces to ensure that no voids remain.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. High strength field bolts will be subject to inspection.
- D. Testing agency will report inspection results promptly and in writing to contractor and Architect
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.5 REPAIRS AND PROTECTION

- A. Touch Up Painting: Following installation, promptly clean, prepare, and prime field connections, rust spots, and abraded surfaces.
  - 1. Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
  - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

END OF SECTION 051200



## SECTION 053100 – STEEL DECKING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Roof deck.
  - 2. Composite floor deck.
  - 3. Non-Composite form deck.
- B. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for concrete fills.
  - 2. Division 5 Section "Structural Steel" for field-welded shear connectors.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
  - 2. Screw fasteners.

#### 1.3 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. AISI "North American Specification for the Design of Cold-Formed Steel Structural Members."
  - 2. SDI "Design Manual for Floor and Roof Decks."
  - 3. SDI "Diaphragm Design Manual."
- B. Manufacturer Qualifications: Member in good standing of Steel Deck Institute (SDI).
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

- D. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

#### 1.4 DELIVERY, STORAGE, AND HANDLING.

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by Nucor Corp.; Vulcraft Division or one of the following:
  - 1. Canam Steel Corporation; The Canam Group.
  - 2. Epic Metals Corporation.
  - 3. New Millennium Building Systems, LLC.
  - 4. Wheeling Corrugating Company; Wheeling-Pittsburgh Steel Corporation.

#### 2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels to comply with "SDI Specifications and Commentary for Steel Roof Deck," and with the following:
  - 1. Deck Profile: As noted on drawings.
  - 2. Profile Depth: As noted on drawings.
  - 3. Design Steel Thickness: As noted on drawings.
  - 4. Prime-Painted Steel Sheet: ASTM A1008, Structural Steel (SS), Grade 33 minimum, cleaned, pretreated, and painted in accordance with manufacturer's standard baked-on, rust inhibitive primer.
  - 5. Color: Gray
  - 6. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, ASTM A 924 G60 zinc coating.
  - 7. Span Condition: Triple span or more where practical.
  - 8. Side Laps: Lapped.

#### 2.3 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and

Commentary for Composite Steel Floor Deck," with the minimum section properties indicated, and with the following:

1. Deck Profile: As noted on drawings.
2. Profile Depth: As noted on drawings.
3. Design Steel Thickness: As noted on drawings.
4. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, ASTM A 924 G60 zinc coating.
5. Span Condition: Triple span or more where practical.

## 2.4 NON-COMPOSITE FORM DECK

A. Non-Composite Steel Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-Composite Steel Form Deck," with the minimum section properties indicated, and with the following:

1. Deck Profile: As noted on drawings.
2. Profile Depth: As noted on drawings.
3. Design Steel Thickness: As noted on drawings.
4. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, ASTM A 924 G60 zinc coating.
5. Span Condition: Triple span or more where practical.
6. Side Laps: Lapped.

## 2.5 ACCESSORIES

- A. General: Provide manufacturer's standard roof or floor accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0358 inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of thickness and profile as recommended by SDI for overhang and slab depth, 16 GA minimum.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same thickness, material, and finish as deck, unless otherwise indicated.

- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib with factory-punched hole of 3/8-inch minimum diameter.
- I. Galvanizing Repair Paint: ASTM A780 with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 3.2 INSTALLATION

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI manual, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 3.3 ROOF DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.

2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in the roof corners and perimeter
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  2. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:
1. End Joints: Lapped 2 inches minimum.
- D. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions.
- E. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FLOOR DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 3/4 inch, nominal.
  2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
  3. Weld Washers: Provide weld washers when deck metal thickness is less than .028 inches.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  2. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:
1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

END OF SECTION 053100

## SECTION 054000 – COLD FORMED STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Load bearing and non-load bearing metal wall framing.
  - 2. Metal floor and ceiling joist framing.
  - 3. Prefabricated metal roof trusses.
  - 4. Formed steel sections, 14 gauge and lighter, for use as bracing, bridging, tracks, furring and fastening.

#### 1.2 REFERENCES

- A. AISI "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. AISI "Standard for Cold-Formed Steel Framing General Provisions."

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and erect cold formed steel framing and connections to withstand design loads within limits and under conditions required.
  - 1. Floor framing members shall withstand design loads without vertical deflections greater than  $1/360$  of the span.
  - 2. Roof framing members shall withstand design loads without vertical deflections greater than  $1/240$  of the span.
  - 3. Wall framing members shall withstand design loads without horizontal deflections greater than  $1/360$  of the span.
  - 4. Wall framing members supporting masonry veneer shall withstand design loads without horizontal deflections greater than  $1/600$  of the span.
- B. Design framing systems to accommodate movement of the structural framing without damage or overstress to members, connections or sheathing.
- C. Engineering Responsibility: Engage a cold formed steel framing manufacturer who utilizes a qualified professional engineer to prepare design calculations, shop drawings, and other structural data for steel joists.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of member, accessory, and product indicated.
- B. Shop Drawings:

1. Detail wall, floor joist, and roof framing layout.
  2. Indicate component details including openings, anchorage, welding, fasteners and accessories required to complete installation.
  3. Provide structural calculations signed and sealed by a professional engineer including loads and stresses for each component.
- C. Welding certificates.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.
  2. Screw fasteners.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel" and AWS D1.3, "Structural Welding Code - Sheet Steel."

#### 1.4 DELIVERY, STORAGE, AND HANDLING.

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Protect materials from corrosion, deformation and other damage during delivery, storage and handling. Protect members from exposure to harmful weather conditions with a ventilated waterproof covering.

### PART 2 - PRODUCTS

#### 2.1 COLD FORMED STEEL FRAMING

- A. Fabricate metal framing units from sheet steel conforming to ASTM A 1003.
1. Finish: Galvanized, Class G60, minimum.
- B. Joists: provide manufacturer's standard shaped sections fabricated from steel.
- C. Framing accessories: Fabricate from minimum 16 gauge steel sheet of the type and finish used for framing members. Provide manufacturer's standard configuration for the following accessories:
1. Track channel
  2. Bridging
  3. Flat strapping



4. Web stiffeners
5. Joist hangers

## 2.2 FASTENINGS

- A. Self-drilling, self-tapping screws, bolts, nuts, and washers, ASTM A 90
- B. Anchorage devices: Hot dipped galvanized or stainless steel, including:
  1. Powder actuated fasteners
  2. Power driven anchor screws
  3. Drilled expansion bolts
  4. Screws with sleeves
- C. Welding: Conform to the requirements of AWS D1.1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 3.2 ERECTION

- A. Install cold formed steel framing and accessories according to the requirements of ASTM C 1007 except where exceeded by other requirements.
- B. Join components by welding, screws, or bolts as recommended by the framing component manufacturer for the members to be joined.
- C. Wall Systems:
  1. Erect framing and panels plumb, level and square in strict accordance with approved shop drawings.
  2. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.
  3. Anchor runner track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
  4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element or butt-weld or splice them together.
  5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.

6. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
7. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations with a maximum spacing of 4'-0".
8. Frame wall openings to include headers and supporting studs as shown in the drawings.
9. Provide temporary bracing until erection is completed.
10. Provide braced walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.
11. As necessary provide for structural vertical movement using a vertical slide clip or other means in accordance with manufacturer's recommendations.

D. FLOOR SYSTEMS:

1. Locate joists directly over bearing studs or provide a suitable load distribution member at the top track.
2. Provide web stiffeners at reaction points as required.
3. Provide joist bridging rows according to manufacturer's recommendations with a maximum spacing of 6'-0".
4. Provide end blocking where joist ends are not otherwise restrained from rotation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings with galvanized repair paint according to ASTM A 780 and manufacturer's instructions.

END OF SECTION 054000

## SECTION 055013 – MISCELLANEOUS STRUCTURAL FABRICATIONS

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous structural fabrications not attached to steel frame.
    - a. Loose steel lintels.
    - b. Other structural fabrications not attached steel frame and not specified elsewhere.
- B. Extent of structural fabrications is indicated on drawings.

#### 1.02 REFERENCES

- A. ASTM A 36/A 36M-94 -- Standard Specification for Carbon Structural Steel; 1994.
- B. ASTM A 53-93a -- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless; 1993.
- C. ASTM A 123-89a -- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 1989.
- D. ASTM A 167-94 -- Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1994.
- E. ASTM A 276-94 -- Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes; 1994.
- F. ASTM A 307-94 -- Standard Specification for Carbon Steel
- G. ASTM A 312/A 312M-94b -- Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes; 1994.
- H. ASTM A 366/A 366M-96 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1996.
- I. ASTM A 446/A 446M-93 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality; 1993.
- J. ASTM A 500-93 -- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 1993.
- K. ASTM A 501-93 -- Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 1993.
- L. ASTM A 525-93 -- Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 1993.
- M. ASTM A 526/A 526M-90 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality; 1990.
- N. ASTM A 554-90 -- Standard Specification for Welded Stainless Steel Mechanical Tubing; 1990.

- O. ASTM A 563-93 -- Standard Specification for Carbon and Alloy Steel Nuts; 1993.
- P. ASTM A 569/A 569M-91a -- Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; 1991.
- Q. ASTM A 570/A 570M-92(93) -- Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality; 1992 (Reapproved 1993).
- R. ASTM A 611-93 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality; 1993.
- S. ASTM A 743/A 743M-93a -- Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 1993.
- T. ASTM A 780-93 -- Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 1993.
- U. ASTM B 26/B 26M-92a -- Standard Specification for Aluminum-Alloy Sand Castings; 1992.
- V. ASTM B 209-96 -- Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 1996.
- W. ASTM B 221-96 -- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes; 1996.
- X. ASTM B 429-92a -- Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 1992.
- Y. ASTM C 1107-91a -- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 1991.
- Z. AWS D1.1-98 - Structural Welding Code - Steel; American Welding Society; 1998.
- AA. AWS D1.3-89 -- Structural Welding Code--Sheet Steel; American Welding Society; 1989.
- BB. MIL P-21035B(NAVY) -- Paint, High Zinc Dust Content, Galvanizing Repair (Metric); 1991.
- CC. FS FF-S-92B -- Screw, Machine: Slotted, Cross-Recessed or Hexagon Head; 1974 (Amended 1975).
- DD. FS FF-W-84A -- Washers, Lock (Spring); 1967 (Amended 1980).
- EE. FS FF-W-92B -- Washer, Flat (Plain); 1974.
- FF. SSPC-Paint 12 -- Cold-Applied Asphalt Mastic (Extra Thick Film); Steel Structures Painting Council; 1991.
- GG. SSPC-Paint 20 -- Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Steel Structures Painting Council; 1991.

### 1.03 SUBMITTALS

- A. Shop Drawings: For each fabricated item show the following:
  - 1. Plans and elevations.
  - 2. Jointing and connections.

- a. Indicate welded connections using standard AWS symbols; indicate net weld length.
- 3. Profiles of sections and reinforcing.
- 4. Fasteners and anchors.
- 5. Accessories.
- 6. Location of each finish.
- B. Product Data: Manufacturer's specifications and installation instructions. Submit for:
  - 1. All manufactured products used in fabrications.
  - 2. Grouts.
- C. Samples of products and materials when requested.

#### 1.04 JOB CONDITIONS

- A. Fit fabrications accurately to actual construction. Record field measurements on shop drawings.
- B. Coordination with Masonry and Concrete Work: Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation, together with coordination drawings and installation instructions.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS - METALS

- A. Steel Shapes:
  - 1. Angles: ASTM A 36.
    - a. Galvanizing: Hot-dip galvanizing after fabrication in accordance with ASTM A 123.

#### 2.02 MATERIALS - MISCELLANEOUS

- A. Grout: Nonshrink, factory blended and packaged; complying with ASTM C 1107.
- B. Concrete: Normal weight ready-mix concrete as specified in Division 3.
  - 1. Compressive strength: 2500 pounds per square inch, minimum, at 28 days, unless otherwise indicated.
- C. Concrete Inserts: Style as required for application.
- D. Fasteners: Use fasteners suitable for the material being fastened and for the type of connection required.
  - 1. For exterior use or built into exterior walls: Nonferrous stainless steel, zinc coated or cadmium plated.
  - 2. Use fasteners of same material as items being fastened unless otherwise indicated.
  - 3. Bolts and studs: ASTM A 307.
  - 4. Nuts: ASTM A 563.
  - 5. Machine screws: FS FF-S-92.
  - 6. Plain washers: FS FF-W-92.
  - 7. Lock washers: FS FF-W-84.
- E. Bituminous Mastic: SSPC-Paint 12.

- F. Galvanizing Repair Paint: Zinc dust paint complying with SSPC-Paint 20 or MIL P-21035B, Type I or II.
- G. Shop Primer: Fabricator's standard primer.

## 2.03 FABRICATION - GENERAL

- A. Fabricate and shop-assemble in largest practical sections for delivery to site.
  - 1. Prepare and reinforce fabrications as required to receive applied items.
  - 2. Fabricate items with joints tightly fitted and secured.
  - 3. Make exposed joints tight, flush, and hairline.
- B. Mechanical Finishes: Complete finishing prior to fabrication wherever possible.
  - 1. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match finish.
  - 2. Protect finish on exposed surfaces by using temporary protective covering.
- C. Anchors: Fabricate to suit substrate indicated; use anchors of same material and finish as item except where specifically indicated otherwise.
- D. Welding:
  - 1. Welding of steel: Comply with AWS D1.1 recommendations.
  - 2. Provide continuous welds at welded corners and seams.
  - 3. Exposed welds: Grind flush and smooth.
- E. Joints Exposed to Weather: Fabricate to keep water out, or provide adequate drainage of water that penetrates.
- F. Items in Contact with Masonry or Concrete: Hot-dip galvanize all steel items which will be in permanent contact with masonry or concrete.

## 2.04 FABRICATION - SHEET METAL

- A. Comply with general fabrication requirements.
- B. Bend sheet metal corners to smallest possible radius.
- C. Welding Steel Sheet: Comply with AWS D1.3 recommendations.

## 2.05 FABRICATION - MISCELLANEOUS STRUCTURAL FABRICATIONS

- A. Loose Lintels: As indicated.
  - 1. Weld double lintels together when indicated.
  - 2. Where bearing dimension is not indicated, provide minimum of 8 inches bearing on each side of opening.
  - 3. Hot-dip galvanize all lintels set in exterior walls.
- B. Shop prime all steel members, except:
  - 1. Galvanized steel members.
  - 2. Steel members embedded in concrete or mortar.
  - 3. Steel members to receive sprayed-on fireproofing.
  - 4. Steel members which are not to receive a finish paint system.
  - 5. Steel members for which an entirely field-applied coating is required.

## PART 3 - EXECUTION

### 3.01 INSTALLATION - GENERAL

- A. Anchor metal fabrications to substrates indicated; provide all fasteners required.
- B. Perform all field fabrication required for installation.
  - 1. Fit joints tightly.
  - 2. Weld joints as indicated.
    - a. Weld in accordance with AWS code.
    - b. Exposed welds: Grind flush and smooth.
- C. Do not cut or weld items galvanized after fabrication that are indicated for bolted or screwed field connections.
- D. Install items in correct location, plumb and level, without rack or warp.
- E. Provide temporary supports and bracing as required.
- F. Coat aluminum surfaces in contact with concrete and masonry with bituminous mastic.

### 3.02 CLEANING AND TOUCH-UP

- A. Touch up damage to galvanized surfaces using galvanizing repair paint in accordance with ASTM A 780.

END OF SECTION 055013





## SECTION 055100 – METAL STAIRS AND RAILINGS

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Metal stairs
  - 2. Wall-mounted railings.
  - 2. Railings not associated with metal stairs.
  - 3. Shop coatings.
- B. Related Sections:
  - 1. Other metal fabrications: Elsewhere in Division 5.

#### 1.02 REFERENCES

- A. 29 CFR 1910.23 -- Occupational Safety and Health Standards; Guarding Floor and Wall Openings and Holes; Code of Federal Regulations; 1974 (with Amendments through 1984).
- B. ASTM A 36/A 36M-94 -- Standard Specification for Carbon Structural Steel; 1993.
- C. ASTM A 53-93a -- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless; 1993.
- D. ASTM A 123-89a -- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 1989.
- E. ASTM A 167-94 -- Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1994.
- F. ASTM A 276-94 -- Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes; 1994.
- G. ASTM A 307-94 -- Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 1994.
- H. ASTM A 312/A 312M-94b -- Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes; 1994.
- I. ASTM A 366/A 366M-96 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1996.
- J. ASTM A 446/A 446M-93 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality; 1993.
- K. ASTM A 500-93 -- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 1993.
- L. ASTM A 501-93 -- Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 1993.
- M. ASTM A 525-93 -- Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 1993.

- N. ASTM A 526/A 526M-90 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality; 1990.
- O. ASTM A 527/A 527M-90 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality; 1990.
- P. ASTM A 554-90 -- Standard Specification for Welded Stainless Steel Mechanical Tubing; 1990.
- Q. ASTM A 563-93 -- Standard Specification for Carbon and Alloy Steel Nuts; 1993.
- R. ASTM A 569/A 569M-91a -- Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; 1991.
- S. ASTM A 570/A 570M-92(93) -- Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality; 1992 (Reapproved 1993).
- T. ASTM A 611-93 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality; 1993.
- U. ASTM A 743/A 743M-93a -- Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 1993.
- V. ASTM A 780-93 -- Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 1993.
- W. ASTM C 1107-91a -- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 1991.
- X. AWS D1.1-98 - Structural Welding Code - Steel; American Welding Society; 1998.
- Y. AWS D1.3-89 -- Structural Welding Code--Sheet Steel; American Welding Society; 1989.
- Z. MIL P-21035B(NAVY) -- Paint, High Zinc Dust Content, Galvanizing Repair (Metric); 1991.
- AA. FS FF-W-84A -- Washers, Lock (Spring); 1967 (Amended 1980).
- BB. FS FF-W-92B -- Washer, Flat (Plain); 1974.
- CC. MIL-M-17194D -- Metal, Expanded, Steel; 1986.
- DD. SSPC-PA 1 -- Shop, Field, and Maintenance Painting; Steel Structures Painting Council; 1991.
- EE. SSPC-Paint 20 -- Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Steel Structures Painting Council; 1991.
- FF. SSPC-SP 1 -- Solvent Cleaning; Steel Structures Painting Council; 1982.
- GG. SSPC-SP 3 -- Power Tool Cleaning; Steel Structures Painting Council; 1989.
- HH. SSPC-SP 7 -- Brush-Off Blast Cleaning; Steel Structures Painting Council; 1985 (with editorial changes 1991).

- II. SSPC-SP 8 -- Pickling; Steel Structures Painting Council; 1985 (with editorial changes 1991).

### 1.03 DEFINITIONS

- A. Quality: Unless otherwise indicated, all requirements of this section apply to all fabricated items. Where "standard quality" is indicated, items identified as "utility quality" need not comply. Where "utility quality" is indicated, the requirement is applicable only to items identified as "utility quality".

### 1.04 PERFORMANCE REQUIREMENTS

- A. Member sizes indicated are minimum; provide sizes required.
- B. Design to resist the loads indicated.
- C. Stair Treads: Design to resist specified uniform load or specified concentrated load applied to 4 square inches in the center of the tread, whichever condition results in the greater stress, unless otherwise indicated.
- D. Handrails: Design to resist the loads specified by applicable building code(s).
- E. Guardrails: Design to resist loads specified by applicable building code(s).
- F. Toeboards: Where toeboards are indicated as required, but are not detailed, design toeboards to conform to the requirements of 29 CFR 1910.23.

### 1.05 SUBMITTALS

- A. Shop Drawings: For each fabricated item, show the following:
1. Plans and elevations.
  2. Jointing and connections.
    - a. Indicate welded connections using standard AWS symbols; indicate net weld length.
  3. Profiles of sections and reinforcing.
  4. Fasteners and anchors.
  5. Accessories.
  6. Location of each finish.
- B. Product Data: Manufacturer's specifications and installation instructions. Submit for:
1. All manufactured products used in fabrications.
  2. Grouts.
- C. Samples of products and materials when requested.

### 1.06 QUALITY ASSURANCE

- A. Where fabrications are specified to comply with specific structural performance requirements, provide design sealed by a professional engineer registered in the state in which the project is located.

### 1.07 JOB CONDITIONS

- A. Fit fabrications accurately to actual construction. Record measurements on shop drawings.

- B. Coordination with Masonry and Concrete Work: Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation, together with coordination drawings and installation instructions.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Pre-Engineered, Pre-Fabricated Steel Stairs: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
  - 1. American Metal Works, Inc.
  - 2. American Stair Corporation.
  - 3. Sharon Companies, Ltd.

### 2.02 METAL STAIRS

- A. Stair between first and second floors:
  - 1. Design is based on custom-designed stairs; at contractor's option, pre-engineered, pre-fabricated stairs having minor deviations from design may be used, provided essential dimensions are maintained, applicable codes are complied with, and performance requirements are met.
  - 2. Design live loads:
    - a. Uniform load: 100 pounds per square foot of horizontal projection.
    - b. Concentrated tread load: 300 pounds.
  - 3. Stringers: Steel channels.
  - 4. Treads: Steel pan, filled with concrete.
  - 5. Risers: Sheet steel.
  - 6. Landings: Steel pan, filled with concrete.
  - 7. Steel finish: Factory primed for painting.
  - 8. Quality: Standard.
- B. Railings:
  - 1. Round steel pipe or tube.
  - 2. Steel finish: Hot-dipped galvanized.
  - 3. Mounting: Wall.
  - 4. Quality: Standard.

### 2.03 MATERIALS - METALS

- A. Steel Shapes:
  - 1. Plates, bars, angles, channels, and H-sections: ASTM A 36.
  - 2. Galvanizing: Hot-dip galvanizing after fabrication in accordance with ASTM A 123.
  - 3. Tube:
    - a. Hot-rolled: ASTM A 501.
    - b. Cold-formed: ASTM A 500.
      - 1. Galvanizing: Hot-dip galvanizing after fabrication in accordance with ASTM A 123.
  - 4. Pipe: ASTM A 53 (black steel and hot-dip galvanized).
    - a. Galvanizing: ASTM A 53, (G185 nominal).
- B. Steel Sheet:
  - 1. For structural uses: Hot-rolled, ASTM A 570; cold-rolled, ASTM A 611.
  - 2. For nonstructural uses: Cold-rolled, ASTM A 366; hot-rolled, ASTM A 569.

- C. Galvanized Steel Sheet:
  - 1. For structural uses: ASTM A 446.
  - 2. For nonstructural uses: ASTM A 526.
  - 3. For lock forming: ASTM A 527.
  - 4. Galvanizing: In accordance with ASTM A 525, G90, unless otherwise indicated.
- D. Stainless Steel Shapes: Type 304 or 316, unless otherwise indicated.
  - 1. Angles, channels, and bars: ASTM A 276.
  - 2. Strip and plate: ASTM A 167.
  - 3. Tube: ASTM A 554.
  - 4. Pipe: ASTM A 312.
  - 5. Castings: ASTM A 743.

#### 2.04 MANUFACTURED COMPONENTS

- A. Expanded Metal Mesh Treads and Platforms:
  - 1. Galvanized steel: MIL-M-17194, Class 2, Grade A.
  - 2. Standard mesh, unless otherwise indicated.
  - 3. Mesh weight: 1/4 inch No. 18.

#### 2.05 MATERIALS - MISCELLANEOUS

- A. Grout: Nonshrink, factory blended and packaged; complying with ASTM C 1107.
- B. Concrete: As specified in Division 3.
- C. Concrete: Normal weight ready-mix; compressive strength of 2500 pounds per square inch, minimum, at 28 days, unless otherwise indicated.
- D. Concrete Inserts: Style as required for application.
- E. Fasteners: Use fasteners suitable for the material being fastened and for the type of connection required.
  - 1. For exterior use: Nonferrous stainless steel, zinc coated or cadmium plated.
  - 2. In exterior walls: Nonferrous stainless steel, zinc coated or cadmium plated.
  - 3. Use fasteners of same material as items being fastened unless otherwise indicated.
  - 4. Bolts and studs: ASTM A 307.
  - 5. Nuts: ASTM A 563.
  - 6. Plain washers: FS FF-W-92.
  - 7. Lock washers: FS FF-W-84.
- F. Galvanizing Repair Paint: Zinc dust paint complying with SSPC-Paint 20 or MIL P-21035B, Type I or II.
- G. Shop Primer: Fabricator's standard primer.

#### 2.06 FABRICATION - GENERAL

- A. Fabricate and shop-assemble in largest practical sections for delivery to site.
- B. Prepare and reinforce fabrications as required to receive applied items.
- C. Smooth off exposed edges and projections that are within reach and would otherwise be uncomfortable to touch.
- D. Joints and Connections:

1. Standard quality fabrications: Make tight and flush joints.
  2. All joints and connections: Welded, except where otherwise indicated.
  3. Exposed fasteners may be used only for joints and connections specifically indicated as requiring exposed fasteners.
- E. Welding: Provide continuous welds at corners and seams.
1. Structural shapes: Comply with AWS D1.1 recommendations.
  2. Sheet metal: Comply with AWS D1.3 recommendations.
  3. Welds exposed to view: Grind flush and smooth.
    - a. Utility quality: Welds need not be ground smooth, but sharp edges and corners must be removed.
- F. Joints Exposed to Weather: Fabricate to keep water out or provide adequate drainage of water that penetrates.
- G. Sheet Metal: Bend corners to smallest possible radius.
- H. Anchors: Fabricate to suit anchors indicated; use anchors of same material and finish as item except where specifically indicated otherwise.

## 2.07 FABRICATION - STAIRS

- A. Construct stairs as indicated; provide all components necessary for support and anchorage, and to provide a complete installation.
- B. Channel-Shaped Members: Provide welded closures for exposed ends.
- C. Provide toe boards at open sides of platforms where stringer does not extend above floor level.
- D. Steel Sheet Treads, Tread Pans and Platforms:
1. Steel sheet: Cold-rolled.
    - a. Minimum thickness: 14 gage
  2. Pan treads and platforms:
  3. Prefabricated pan treads, complete with concrete fill, may be used; attach to stringers by manufacturer's standard method.
  4. Aggregate for nonslip finish on concrete: Aluminum oxide grit or crushed emery abrasive aggregate.
  5. Pan tread nosing: Integral with pans, with not more than 1/2 inch return.
- E. Grating Treads and Platforms:
1. Nosing: Integral, nonslip.
  2. Attach treads to stringers using brackets bolted or welded to treads and bolted or welded to stringers.

## 2.08 FABRICATION - RAILINGS

- A. General: Construct as indicated.
1. Round pipe/tube: Minimum inside diameter of 1 1/4" inches.
  2. Pipe/tube: Nominal wall thickness of 0.125 inch.
  3. Connections: Welded and ground.
  4. Welding: Fill joints completely and grind off flush.
  5. Elbows: Mitered, only.
  6. Tee and cross intersections: Coped and fitted.
  7. Exposed ends of hollow members: Close with prefabricated fittings or with 3/16-inch-thick plate fully welded.

8. Bending of members: Use jigs to make each similar configuration the same; make neat bends without other deformation.
  9. Close exposed open ends of members using same material as used in member.
- B. Provide all components necessary for assembly of railings and for attachment to other work.
- C. Wall-Mounted Handrails: Return railing to wall at ends except where otherwise indicated.

## 2.09 FINISHING

- A. Galvanizing for Members Other than Sheet: Hot-dip galvanize after fabrication.
- B. Preparation of Steel for Finishing: Prepare by removing loose mill scale, loose corrosion products, dirt, oil, and grease.
1. Use pickling, blast cleaning, or power tool cleaning, as required.
    - a. Pickling: Perform in accordance with SSPC SP-8.
    - b. Blast cleaning: Perform in accordance with SSPC SP-7, minimum.
    - c. Power tool cleaning: Perform in accordance with SSPC SP-3.
    - d. For exterior fabrications, use blast cleaning in accordance with SSPC SP-6, minimum.
  2. Standard quality: Grind off projections on exposed surfaces and fill holes and depressions.
  3. Solvent clean in accordance with SSPC-SP 1.
- C. Priming: Apply primer in shop immediately after preparation; comply with SSPC-PA 1.
1. Apply extra coat to corners, welds, edges, and fasteners.
  2. Shop prime all steel members of fabrications indicated to be factory-primed for painting.
    - a. Exceptions:
      1. Surfaces to be field welded.
      2. Surfaces in direct contact bond with concrete.
      3. Fire Stair at North side of building.
- D. Protect finishes on exposed surfaces from damage by using temporary protective coverings.
1. Where corrosion occurs prior to application of finish coating, clean corroded areas and re-apply shop coatings.
  2. Touch up damaged factory finishes as recommended by fabricator.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install items in correct location, plumb and level, without rack or warp.
- B. Provide temporary supports and bracing as required.
- C. Anchor to substrates indicated; provide all fasteners required.
- D. Perform all field fabrication required for installation.
1. Fit joints tightly.
  2. Weld joints as indicated.
    - a. Weld in accordance with AWS code.

- b. Exposed welds: Grind flush and smooth.
- E. Do not cut or weld items galvanized after fabrication that are indicated for bolted or screwed connections.
- F. Fill steel pans with concrete, as indicated; make surface level.
  - 1. Embed aggregate for non-slip finish uniformly into concrete surface.

### 3.02 CLEANING AND TOUCH-UP

- A. Touch up damage to galvanized surfaces using galvanizing repair paint in accordance with ASTM A 780.
- B. Touch up shop paint immediately after erection.
  - 1. Clean field welds, bolted joints and areas where primer is damaged.
  - 2. Paint with material used for shop painting, minimum 2 mils dry film thickness.

END OF SECTION 055100



## SECTION 055133 – METAL LADDERS

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Aluminum wall ladders, including parapets, cages and handrails.
  - 1. Types: Types of aluminum wall ladders include:
    - a. Fixed Wall Ladder – Elevator Pit Access
    - b. Fixed Wall Ladder - Custom Platform Roof Ladder
- B. Related Sections: Section(s) related to this section include:
  - 1. Section 061000 - Rough Carpentry for required wood blocking.

#### 1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide aluminum wall ladders which have been manufactured, fabricated and installed to withstand loads from Building Code of New York State and to maintain performance criteria stated by manufacturer without defects, damage or failure.
- B. Ladder Performance Requirements:
  - 1. Aluminum Fixed Wall Ladders: Certified to meet ANSI A14.3 as an OSHA Type I industrial metal ladder.
  - 2. Solid Rivets: 4 per rung with combined shear strength in excess of 3600 lb (16,020 N).

#### 1.03 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data, including manufacturer's product sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, product components, accessories and finishes.
- D. Samples: Submit selection and verification samples for finishes.
- E. Quality Assurance Submittals: Submit the following:
  - 1. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Closeout Submittals: Submit the following:
  - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Warranty: Warranty documents specified herein.

## 1.04 QUALITY ASSURANCE

### A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- B. Regulatory Requirements: OSHA and ANSI A14.3.
- C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

## 1.05 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

## 1.06 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
1. Warranty Period: 1 year commencing on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURER

#### BASIS OF DESIGN:

- A. Manufacturer: ALACO Ladder Company.
1. Contact: 5167 "G" Street, Chino, CA 91710-5143;  
Telephone: (888) 310-7040; Fax: (909) 591-7565.
- C. Architect Approved Equal.

## 2.02 FIXED WALL LADDERS - ELEVATOR PIT ACCESS

### BASIS OF DESIGN:

- A. Fixed Wall Ladders- Model 561-E- Elevator Pit Access
- B. Basic Use:
  - 1. Model 561-E fixed wall, side exit ladders provide permanent elevator pit maintenance access. They are ideal for tanks, water treatment plants, refineries and other industrial or marine applications. This ladder has a narrower wall offset to allow for elevator clearance in the elevator pit.
- C. Construction Materials:
  - 1. Components are fabricated from 6061-T6 aluminum alloy for added safety, strength and long-lasting durability, with no painting required.
  - 2. Model 561-E fixed wall elevator pit ladders include side rails with 1-1/8" (29 mm) round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8" (9.5 mm) thick brackets mounted to the walls.
- D. Size:
  - 1. Climb Height: Maximum 20' (6.1 m) pit floor to floor level.
  - 2. Width: 20-1/4"
- E. Finishes and Coatings:
  - 1. Mill finish is standard on aluminum ladders.
  - 2. Factory applied paint coatings and chem-film treatment for field applied primers are available upon request.
  - 3. Custom coatings and surface treatments are also offered.

## 2.03 CUSTOM PLATFORM ROOF LADDER

- A. Custom Fixed Wall Ladders with Crossover Platform.
  - 1. Custom ladders to be similar to standard models Model 564-Parapet return w/ crossover platform as well as Model 561 – Handrail over roof ladders.
  - 2. Contractor to provide shop drawings for approval of custom ladder prior to fabrication.
- B. Basic Use:
  - 1. Fixed wall ladders provide permanent exterior roof access. Ladders are less than 20' therefor do not require a cage. Walk-Through with platform and handrail extensions are required.
- C. Construction Materials:
  - 1. Components are fabricated from 6061-T6 aluminum alloy for added safety, strength and long-lasting durability, with no painting required.

2. Fixed wall ladders include side rails with 1-1/8" (29 mm) round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8" (9.5 mm) thick brackets mounted to the walls. Crossover Platform - The platform consists of GripStrut® floors and 4" (102 mm) high toe boards.
  3. Accessories include the following items:
    - a. Rest Platform - These platforms consist of GripStrut® floors, 4" (102 mm) high toe boards, 1-1/4" (32 mm) round serrated tube guard railings and cast aluminum railing fittings.
- D. Size:
1. Climb Height: Per drawings. Height exceeding 20' installed with cage.
  2. Width: 20-1/4"
- E. Finishes and Coatings:
1. Mill finish is standard on aluminum ladders.
  2. Factory applied paint coatings and chem-film treatment for field applied primers are available upon request.
  3. Custom coatings and surface treatments are also offered.

## 2.04 FABRICATION

- A. Aluminum Ladder Fabrications:
1. General: Fabricate tread aluminum stairs to conform with performance and construction requirements, and in accordance with approved shop drawings and/or dimensional prints. Fabricate and shop-assemble to greatest extent possible.
- B. Handrail, Cage:
1. General: Fabricate handrails and cages to conform with dimensions, performance, and construction requirements, and in accordance with approved shop drawings or dimensional prints.
  2. Aluminum: Cut, formed, and punched parapets, handrails, cages, rest platforms and security doors with mounting brackets and kickplates possibly gas tungsten arc welded or gas metal arc welded with bolt-on handrails.

## 2.05 SOURCE QUALITY

- A. Source Quality: Obtain aluminum wall ladders from a single manufacturer.

## PART 3 EXECUTION

### 3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

### 3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
  - 1. Verification: Verify that dimensions and angle are correct and that substrate is in proper condition for ladder installation. Do not proceed to install until all necessary corrections have been made.

### 3.03 PREPARATION

- A. Coordination: Coordinate start and installation of tread stairs with other related and adjacent work. Installation shall not start until construction has progressed to point that weather conditions and remaining construction operations will not damage ladder installation.

### 3.04 INSTALLATION

- A. Aluminum Ladders Installation:
  - 1. Series 560 Fixed Aluminum Ladders.
    - a. Detail top rung at or slightly above stepping-off surface and space rungs 12" (305 mm) oc to bottom rung, which is installed 12" (305 mm) from the floor.
    - b. Space wall mounting brackets 6' (1.8 m) oc, with floor brackets recommended at bottom end.
    - c. Install parapet railing 42" (1067 mm) above top rung, then extend 24" (610 mm) horizontally and return to roof or the rear of parapet. Rungs can be shown returning to the roof if the parapet is high enough to require them.
    - d. Touch up with matching paint any chipped or abraded damage to factory finish or coating.
    - e. Apply primer or paint to pretreated surface.
- B. Handrails and Cages:
  - 1. Install ALACO flared cage between 7' - 8' (2 - 2.4 m) above the floor if installation exceeds 20' (6 m) in height.
  - 2. Touch up with matching paint any chipped or abraded damage to factory finish or coating.
  - 3. Apply primer or paint to pretreated surface.

### 3.05 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

### 3.06 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 055133

## SECTION 061000 – ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Wood blocking and nailers
2. Wood furring
3. Wood sleepers
4. Plywood Sheathing
5. Plywood backing panels

#### 1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood
2. Fire-retardant-treated wood
3. Power-driven fasteners
4. Powder-actuated fasteners
5. Expansion anchors
6. Metal framing anchors

#### 1.3 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Dimension lumber framing
2. Miscellaneous lumber

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all rough carpentry, unless otherwise indicated.
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

### 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
  - 1. Use Exterior type for exterior locations and where indicated.
  - 2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
  - 3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat all rough carpentry, unless otherwise indicated.
  - 1. Framing for raised platforms
  - 2. Concealed blocking



3. Framing for non-load-bearing partitions
4. Framing for non-load-bearing exterior walls
5. Roof construction
6. Plywood backing panels

## 2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent
- B. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of any species
- C. Framing Other Than Non-Load-Bearing Interior Partitions: No. 2 grade and any of the following species:
  1. Hem-fir (north); NLGA
  2. Douglas fir-larch; WCLIB or WWPA
  3. Spruce-pine-fir; NLGA
- D. Framing Other Than Non-Load-Bearing Interior Partitions: Any species and grade with a modulus of elasticity of at least 1,500,000 psi (10 350 MPa) and an extreme fiber stress in bending of at least 1000 psi (6.9 MPa) for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

## 2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  1. Blocking
  2. Nailers
  3. Rooftop equipment bases and support curbs
  4. Cants
  5. Furring
  6. Grounds
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
  1. Mixed southern pine, No. 2 grade; SPIB
  2. Eastern softwoods, No. 2 Common grade; NeLMA
  3. Northern species, No. 2 Common grade; NLGA
  4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA

## 2.6 PLYWOOD SHEATHING

- A. Roof Sheathing: 3/4" APA CDX Plywood. C-D Exposure 1 with exterior glue.
- B. Plywood Nailers: APA CDX Plywood. C-D Exposure 1 with exterior glue. Thickness as shown on drawings.
- C. Plywood Subfloor: 3/4" APA CDX T&G Plywood. C-D Exposure 1 Tongue and Groove Edges.

## 2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated

## 2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers

## 2.9 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpine Engineered Products, Inc.
  - 2. Cleveland Steel Specialty Co.
  - 3. Harlen Metal Products, Inc.
  - 4. KC Metals Products, Inc.
  - 5. Simpson Strong-Tie Co., Inc.
  - 6. Southeastern Metals Manufacturing Co., Inc.
  - 7. USP Structural Connectors
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

## 2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code
  - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code
  - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code
  - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code
  - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code

### 3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000



## SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking, cants, and nailers.

- B. Related Sections:

- 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.

#### 1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Category UC3b
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

## 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Rooftop equipment bases and support curbs.
  4. Cants.
  5. Substrate boards for roof or wall flashings.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053



## SECTION 062000 – FINISH CARPENTRY

### PART 1 - GENERAL

#### 1.01 DESCRIPTION OF WORK

- A. Provide all finish carpentry Work as indicated on the Drawings and as specified herein.

#### 1.02 SUMMARY

- A. Section Includes:

1. Interior trim
2. Interior plywood paneling.
3. Interior Built-In wood benches
4. Interior Custom Casework

#### 1.03 SUSTAINABILITY REQUIREMENTS

- A. Sustainability requirements included in the Section are as follows:

1. Restrictions on the use of urea-formaldehyde containing materials.

#### 1.04 REFERENCES

- A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Architectural Woodwork Institute (AWI) Architectural Woodwork Quality Standards
2. American Society for Testing and Materials (ASTM) E84 Standard Test Method for Surface Burning Characteristics of Building Materials
3. American National Standards Institute (ANSI) ANSI A208.1
4. Underwriter's Laboratories, Inc. (UL)

#### 1.05 SUBMITTALS

- A. Product Data

Submit manufacturers or supplier's product data for each product and process specified as work of this Section and incorporated into items of finish carpentry.

- B. Quality Certification

Submit woodwork Manufacturer's (Fabricator's) certification, stating that fabricated woodwork complies with AWI quality grades and other requirements indicated herein.

- C. Wood Treatment Data

Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finish of treated material.

D. Fire-Retardant Treatment

Provide certification by treating plant that treated materials comply with requirements.

E. Shop Drawings

Submit Shop Drawings showing location of each fabricated item, dimensioned plans and elevations, large scale details and profiles, attachment devices and other components.

1. Identify woodwork item using same identification system shown on Architectural Drawings.
2. Coordinate details and cut-outs to accommodate accessories specified under other Sections.

F. Samples

1. Wood Components: 12" x 12" of each type and finish (e.g., custom casework and wood benches).
2. Wood Trim: 12" length of each type and finish (e.g., base, casings, stools, aprons, chair rail).
3. Plywood Paneling: 12" x 12" for each type and finish.

G. Low Emitting Materials Compliance Submittals

1. Provide documentation for each adhesive and glue to be used on site, indicating that the adhesives comply with low V.O.C. requirements.
2. Submit manufacturer's documentation that composite wood products, including plywood, that are used are manufactured without the use of any added urea-formaldehyde. This requirement includes binders, and laminating adhesives used in the field or shop. Submit manufacturer's documentation of the resin(s).

1.06 QUALITY ASSURANCE

A. AWI Quality Standard

Comply with applicable requirements of the AWI "Architectural Woodwork Quality Standards", except where indicated otherwise.

B. Fabrication and Installation Qualifications

Firm which can demonstrate a minimum of 5 years of successful experience in fabricating and installing woodwork items similar in type and quality to those required for this project.

C. Submit name of firm to the Authority for approval.

D. Regulatory Agencies

Fire-retardant treated wood shall be certified by one of the following:

1. National Recognized Testing Agency
  2. OTCR
- E. All plywood, composite wood products and laminating adhesives used shall contain no added urea-formaldehyde.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver woodwork until operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If woodwork must be stored, store only in areas meeting requirements and conditions specified for installation areas.

#### 1.08 PROJECT CONDITIONS

##### A. Conditioning

Woodwork Installer shall advise the Construction Manager of temperature and humidity requirements, in writing for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized.

- B. Maintain temperature and humidity conditions in installation area as required to maintain moisture content of installed woodwork within 1.0 percent of optimum moisture content as follows:
  1. Optimum moisture content of wood: 5-10%
  2. Relative humidity required to be maintained in installation and storage areas: 25-55%

### PART 2 - PRODUCT

#### 2.01 MATERIAL

##### A. General

1. All interior wood finish shall be made up of thoroughly seasoned, kiln dried woods of the kinds specified.
2. All material shall be clear on all exposed faces and edges, free from checks, cracks or other blemishes that would mar the appearance of the finished wood.
3. In assembling interior woodwork, arrange so that variations in grain pattern are kept to a minimum.
4. All material shall be product of one mill.
5. All plywood and laminating adhesives used shall contain no added urea-formaldehyde.

##### B. Species and Grades (Lumber)

1. W-1: Plain Sawn Red Oak, AWI Grade A1 (for transparent finish): all interior wood finish in Lobby, except as otherwise specified or shown on Drawings.
- C. Species, Grades, Types (Plywood)
1. Veneer: Red Oak, as specified herein, AWI Grade A1.
  2. Grain Appearance: Running Match.

## 2.02 FABRICATION, GENERAL

### A. Wood Moisture Content

Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity in installation areas. (See Art. 1.07).

### B. Fabricate woodwork to dimensions, profiles, and details indicated.

### C. Complete fabrication, assembly, finishing, and other work before shipment to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary, provide ample allowance for scribing, trimming, and fitting.

### D. Pre-Cut Openings

Provide woodwork with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts.

### E. Measurements

Before fabrication of woodwork to be fitted to other construction, obtain field measurements and verify dimensions and shop drawings detail as required for accurate fit.

1. Where field measurements before fabrication would delay the project, fabricate without field measurements and provide ample borders and edges to allow for scribing and trimming of woodwork.

## 2.03 FIRE-RETARDANT MATERIALS

### A. Where fire-retardant treated lumber, plywood, and panel products are required by Building Code or indicated on the drawings, provide materials which are pressure impregnated with fire-retardant chemicals and comply with the following requirements:

1. Fire-Retardant Chemicals: Use chemicals which do not bleed through or otherwise adversely affect adhesives or finishes. Do not use colorants to distinguish treated lumber and panels from untreated lumber and panels.

### B. Fire-Performance Characteristics

Provide materials which are identical to those tested in accordance with ASTM methods and time periods indicated, are listed for fire performance characteristics by Underwriter's Laboratories, Inc., or other testing agency acceptable to authorities having jurisdiction.

1. Marking: Identify treated lumber with separable paper classification marking of inspecting and testing agency.

2. Surface Burning Characteristics: Not exceeding values indicated below, tested in accordance with ASTM E84 for 30 minutes which no evidence of significant combustion.
  - a. Flame Spread: 25.
  - b. Smoke Developed: 50.
- C. Kiln-dry woodwork after treatment to levels required for non-fire-retardant woodwork materials. Maintain moisture content required by kiln drying, before and after treatment. Do not use treated lumber which does not comply with requirements of referenced woodworking standard.
- D. Where fire-retardant particleboard and fiberboard are used, provide panels with fire-retardant chemicals to achieve surface-burning characteristics of 20 for flame spread and 25 for smoke developed when tested in accordance with ASTM E84.

Comply with ANSI A208.1 for Grade M-1 panels. Minimum density 40 lbs./cu. ft.

Linear expansion: Maximum average 0.35%.

#### 2.04 LUMBER THICKNESS

- A. Finish thicknesses of members, and tolerances permitted:

Comply with AWI Section 3, 4.2.1.

#### 2.05 GLUING

- A. Gluing for wood member thickness and for wood member width

Comply with AWI- Section 3, 4.2a.

### PART 3 - EXECUTION

#### 3.01 CONDITION OF SURFACES

- A. Examine all grounds, stripping and blocking, to secure paneling and other items provided under this Section.
- B. Do not install until all defects are corrected.

#### 3.02 INSTALLATION

- A. Install woodwork plumb and level without distortion.
- B. Shim as necessary with concealed shims.
- C. Accurately scribe and closely fit all face plates, filler strips and trim strips to irregularities of adjacent surfaces.
- D. Do all Work in strict accordance with the details for the various portions of the Work.

- E. For adjoining pieces of hardboard, carefully select to match the color and grain as closely as possible.
- F. Interior finish  
  
High-speed machine work, free from planing machine marks, sandpapered smooth, ready to receive paint or varnish.
- G. Carefully fit woodwork and secure with finishing nails; countersink nails.
- H. Do not allow kerfing on faces of trim or moldings.
- I. Properly house stiles and rails into framework and properly nail and glue all parts together.
- J. Miter, with miters doweled or clamped, all trim joints except window trim.
- K. Round base and all other moldings on walls at all salient angles; where columns occur in partitions, follow contour.
- L. Install all trim, when applied to a surface less than 13 feet in length, in one length: no piecing will be accepted. Provide bevel joints, where joints are required; no butt joints will be accepted.
- M. In addition to machine sanding, sand all interior woodwork by hand with 00 sandpaper to give trim a smooth surface for finishing.

### 3.03 APPLYING HARDWARE

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
  - 1. Where finish carpentry materials are exposed, provide fasteners and anchorages with a black matt finish or as approved by AOR.
- B. Apply all miscellaneous hardware not specified to be installed under Section 087100 and other Sections.

#### LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:	_____	_____
1. Manufacturer's or supplier's product data for each product and process		
Quality Certification:	_____	_____
1. Compliance with AWI quality grades and other requirements		
Wood Treatment Data:	_____	_____

1. Chemical treatment manufacturer's instructions

Fire-Retardant Treatment:

1. Certification by plant.
2. Certification of approval by Nationally Recognized Testing Agency

Shop Drawings:

1. Location of each fabricated item
2. Dimensioned plans and elevations
3. Large scale details and profiles
4. Attachment devices and other components

Samples:

1. Wood Components - For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 12 by 12 inches for panels
2. Wood Trim - 12" length of each type and finish (e.g., base, casings, stools, aprons, chair rail)
3. Plywood Paneling - 12" x 12" for each type and finish

Quality Assurance:

1. Certification of experience

Project Conditions:

1. Temp. and humidity reqmt's. for storage and installation

Sustainability:

1. Manufacturer's documentation that composite wood products contain no added urea-formaldehyde. Document binder used.
2. Manufacturer's documentation that laminating adhesives, both field and shop applied, contain no added urea-formaldehyde. Document binder used.

END OF SECTION 062000





## SECTION 066116 – SOLID SURFACING FABRICATIONS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. Work described in this section:

1. Window sills
2. Built-in countertops

B. Related work specified elsewhere:

1. Aluminum Windows – 085113

#### 1.02 REFERENCES

A. Applicable Standards: Standards of the following, as referenced herein:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. National Electrical Manufacturers Association (NEMA)
4. Federal Specifications (FS)

#### 1.03 SUBMITTALS

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 2" x 2" samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

#### 1.04 QUALITY ASSURANCE

A. Allowable tolerances:

1. Variation in component size:  $\pm 1/8"$ .
2. Location of openings:  $\pm 1/8"$  from indicated location.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.

## 1.06 WARRANTY

- A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

## PART 2 - PRODUCTS

### 2.01 SOLID POLYMER FABRICATIONS

- A. Preferred products: 1. du Pont de Nemours & Co. Inc, Corian  
2. AYONITE  
3. SUREAL
- B. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
1. Material shall have minimum physical and performance properties specified in the following Section U.
2. Superficial damage to a depth of 0.010" shall be repairable by sanding and polishing.
- C. Counter Top: 1" thick solid polymer material, adhesively joined with inconspicuous seams; edge details as indicated on the Architect's Drawings; white color. [Technical Bulletin: 130].
- D. Performance characteristics:

PROPERTY	REQUIREMENT	TEST PROCEDURE
	(min or max)	
Tensile Strength	5000 psi min	ASTM D638
Tensile Modulus	$1.0 \times 10^6$ psi min	ASTM D638
Flexural Strength	7000 psi min	ASTM D790
Flexural Modulus	$1.0 \times 10^6$ psi min	ASTM D790
Elongation	0.3% min.	ASTM D638
Hardness	90-Rockwell "M" scale min. 52-Barcol Impresser min.	ASTM D758 ASTM D2583
Thermal Expansion	$3.5 \times 10^{-6}$ in/in/deg C. max. $1.95 \times 10^{-6}$ in/in/deg F. max.	ASTM D696
Color Stability	No change, 100 hours min.	NEMA LD3-3.10
Wear and Cleanability	Passes	ANSI Z124.3
Abrasion Resistance	No loss of pattern max. weight loss (1000cycles) =0.9g.	NEMA LD3-3.01 ANSI Z124.3
Boiling water Surface Resistance	No Change	NEMA LD3-3.05
High Temperature Resistance	No Change	NEMA LD3-3.06
Impact Resistance Notched Izod Gardner	0.24 ft.-lbs.min. 9.0 ft-lbs min.	ASTM D256, Method A ASTM D3029
Ball drop 1/4" sheet 1/2" sheet 3/4" sheet	36" min, 1/2 lb ball, no failure 140" min, 1/2 lb ball, no failure 200" min, 1/2 lb ball, no failure	NEMA LD3-303

Bowls (point impact)	No cracks or chips		ANSI Z124.3 and 124.6	
Stain Resistance	Passes		ANSI Z124.3	
Weatherability	No change,min. 1000 hours		ASTM D1499	
Fungi and Bacteria	No Attack		ASTM G21, ASTM G22	
Specific Gravity	1.6 min			
Water Absorption Weight (% max.)	24 hrs. 0.05 0.10	Long Term 0.50(1/4") 0.90(3/4")		ASTM D570
Flammability			ASTM E84	
		solid colors		
	1/4"	1/2"	3/4"	
Flame spread	25 max	25 max	25 max	
Smoke Developed	30 max	30 max	30 max	
Class	1	1	1	
		particulate patterns		
	1/4"	1/2"	3/4"	
Flame spread	25 max	25 max	25 max	
Smoke Developed	30 max	30 max	30 max	
Class	1	1	1	
Pittsburgh Protocol Toxicity (as used by NY State)	solids-80 gms minimum rating patterns-65 gms minimum			"LC50" Test

## 2.02 ACCESSORY PRODUCTS

- A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond. (Technical Bulletin: CTDC 102)
- B. Sealant: Manufacturer's standard mildew-resistant, FDA/UL® recognized silicone sealant in color matching or clear formulations. (Technical Bulletin: 102, 127)

## 2.03 FABRICATION

- A. For warranty coverage, fabricator/installer shall be approved by solid polymer manufacturer.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.
- C. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- D. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- E. Finish: All surfaces shall have uniform finish.

1. Matte, with a gloss rating of 5 - 20.

## PART 3 - EXECUTION

### 3.01 JOB MOCK-UP

- A. Prior to final approval of shop drawings, erect one full size mock-up of each component at project site for architect review.
- B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.
- C. Approved mock-ups shall remain as part of finished work.

### 3.02 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.
- D. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- E. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to architect's satisfaction and invoice for the cost of repairs. Architect to pre-approve cost estimate before repairs are made.

END OF SECTION 066116

## SECTION 072100 – BUILDING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Concealed building insulation.
  - 2. Sound Attenuation.
  - 3. Spray Polyurethane Foam Insulation.
  - 4. Vapor retarders.
- B. Related Sections include the following:
  - 1. Section 072113 "Continuous Insulation".
  - 2. Division 7 Section "Fire Resistant, Fluid Applied Membrane Air Barriers".
  - 3. Division 9 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by reference to this Section.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Extruded-Polystyrene Board Insulation:
    - a. Dow / Styrofoam. Cavity Mate SE.
    - b. Owens Corning.
    - c. Plymouth Form Incorporated – Gold Wall Insulating System
  - 2. Glass-Fiber Insulation:
    - a. CertainTeed Corporation.
    - b. Johns Manville Corporation.
    - c. Knauf Fiber Glass.
    - d. Owens Corning.
  - 3. Slag-Wool-/Rock-Wool-Fiber Insulation:
    - a. Fibrex Insulations Inc.
    - b. Owens Corning.
    - c. Thermafiber.
  - 4. Sound Attenuations Fire Batts Insulation / MW:
    - a. Owens Corning.
    - b. Fibrex Insulations Inc.
    - c. Thermafiber.
  - 5. Spray Polyurethane Foam Insulation
    - a. Dow/Styrofoam MX Series.
    - b. Owens Corning.
    - c. Johns Manville Corporation.

6. Vapor Retarders
  - a. Raven Industries, Inc.
  - b. Reef Industries, Inc.  
Architect Approved Equal.

## 2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
  1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
  1. Type X – 15 psi.
- C. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- D. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass.
- E. Sound Attenuation Fire Batts Insulation/MW:
  1. ASTM C 665, Type I This material is considered non combustible per ASTM C 136. Surface burning characteristics per ASTM E84 Flame spread of 5.
- F. Spray Polyurethane Foam Insulation: Two-component spray polyurethane cellular plastic foam. Complying with the following methods and meeting the following physical properties:
  1. Core Density (ASTM D1622): Min. Z pcf
  2. Thermal Resistance (ASTM C518): 140 degree F/90 day aged R-value, measured at 75 F mean Temp: min R6.0/inch
  3. Flame Spread (ASTM E84, Class A): 25 or less
  4. Smoked Developed (ASTM E84, Class A): 450 or less
  5. Compressive Strength Minimum (ASTM D1621, 10% parallel to rise): (20 psi) (182 kPa)
  6. Closed Cell Content (ASTM D2856): minimum 95 percent
  7. Water Absorption by Volume Maximum (ASTMD2842): 2.5 percent
  8. Water Vapor Permeability maximum (ASTME96): 2.5 perm – inch

## 2.3 VAPOR RETARDERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Reinforced-Polyethylene Vapor Retarders:
    - a. Raven Industries, Inc.; DURA-SKRIM 2 - 6 MIL.
    - b. Reef Industries, Inc.; Griffolyn TX 1200 - 6 MIL.
- B. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of high-strength polyethylene film laminated to an inner reinforcing layer consisting of polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating per ASTM E96 procedure B.
- C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## 2.4 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Protection Board: Premolded, semirigid asphalt/fiber composition board, 1/4 inch thick, formed under heat and pressure, of standard sizes.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

## 2.5 INSULATION FASTENERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Adhesively Attached, Spindle-Type Anchors:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  - 2. Insulation-Retaining Washers:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
  - 3. Insulation Standoff:
    - a. Gemco; Clutch Clip.
  - 4. Anchor Adhesives:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.



- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
  - 1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches (50 mm) square.
  - 2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
  - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Ceiling plenums.
    - b. Attic spaces.
    - c. Where indicated.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
  - 1. Air Space: 1 inch (25 mm).
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF BLANKET INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
  - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

### 3.5 INSTALLATION OF INSULATION FOR SOUND ATTENUATION:

- A. Install 3 ½" unfaced Sound Attenuation Fire Batts / MW blanket insulation in stud wall cavities. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will provide a snug fit between ends.

### 3.6 INSTALLATION OF SPRAY POLYURETHANE FOAM INSULATION

- A. Must be applied by manufacturer approved applicator.
- B. Apply SPF in accordance with ASTM C1029 and manufacturers installation guidelines.
- C. Apply spray foam in consecutive layers of not less than (1/2 inches) and not more than (2 inches) thick each to achieve total thickness required. For light-gauge steel and polystyrene board first layer should be a skim coat of 1/2" before adding extra layers.

### 3.7 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.8 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100



## SECTION 072113 – CONTINUOUS INSULATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Continuous Insulation XCI Foil wall panels.
- B. Continuous Insulation XCI Foil (Class A).

#### 1.2 RELATED SECTIONS

- A. Section 033000 – Cast-In-Place Concrete: Concrete base wall.
- B. Section 042113 - Brick Masonry: Brick facing
- C. Section 042200 - Concrete Unit Masonry
- D. Section 047200 - Cast Stone Masonry
- E. Section 072726 - Air Barriers: Air seal materials over insulation to adjacent insulation.

#### 1.3 REFERENCES

- A. ASTM C 209 – Methods of Testing Insulating Board, Structural and Decorative.
- B. ASTM C 518 – Steady State Thermal Transmission by Means of the Heat Flow Meter Apparatus (R Value)
- C. ASTM C 1289 – Specifications for Faced Rigid Cellular Polyisocyanurate Thermal Insulating Board.
- D. ASTM D 1621 – Test Methods for Compressive Properties of Rigid Cellular Plastics.
- E. ASTM D 2126 - Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- F. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- G. ASTM E 84 (UL 723) - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E 96 - Test Method for Water Vapor Transmission of Materials.
- I. ASHRAE 90.1-2010 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- J. IBC Chapter 26 – Foam Plastic Insulation.
- K. Miami-Dade County FL NOA No: 14-0501.01.
- L. ICC-ES Evaluation Report - ICC-ESR-3174

- M. DRJ Technical Evaluation Report #1402-02
- N. NFPA 285 - Standard Fire Test Method For Evaluation Of Fire Propagation Characteristics Of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- O. UL 723 - Test for Surface Burning Characteristics of Building Materials
- P. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
- Q. ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Window, Curtain Walls and Doors Under Specific Pressure Differences Across the Specimen
- R. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- S. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- T. ASTM E 2178 – Standard Test Method for Air Permeance of Building Materials
- U. ASTM E 2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- V. California Bureau of Furnishings and Home Insulation
- W. IBC Chapter 26 – Foam Plastic Insulation

#### 1.4 SYSTEM DESCRIPTION

- A. NFPA 285 Exterior Wall Assembly – Concrete Masonry Construction:
  - 1. Base Wall System:
    - a. Cast in Place Concrete
    - b. CMU Wall.
  - 2. Approved Exterior Finish:
    - a. Masonry: Brick veneer anchors, standard types, installed maximum 24 inches o.c. vertically. Maximum 2 inch air gap between exterior insulation and brick. Standard nominal 4 inches thick or greater, clay brick.
    - b. Cast Artificial Stone Veneer. Any standard installation technique can be used.
  - 3. Panel Thickness:
    - a. 3.5 inches maximum, NFPA 285 approved.
    - b. 3.6 to 4.0 inches, contact Hunter Panels Xci for NFPA 285 approvals.
  - 4. Floorline Firestopping: 4 lb/cu ft mineral fiber based safing insulation at each floor line, attached with Z Clips or equivalent.
  - 5. Weather Resistive Membrane Applied to Base Wall: Acceptable products are:
    - a. Carlisle:
      - 1) Fire Resist Barritech VP or equal
- B. NFPA 285 Exterior Wall Assembly – Cast-in-Place:

1. Base Wall System: Concrete Masonry Wall.
2. Approved Exterior Finish:
  - a. Masonry: Brick veneer anchors, standard types, installed maximum 24 inches o.c. vertically. Maximum 2 inch air gap between exterior insulation and brick. Standard nominal 4 inch thick or greater, clay brick.
  - b. Cast Artificial Stone Veneer. Any standard installation technique, including shiplap can be used.
3. Panel Thickness: 3.5 inches maximum.
4. Floorline Firestopping: 4 lb/cu ft mineral fiber based safing insulation at each floor line, attached with Z Clips or equivalent.
5. Weather Resistive Membrane Applied to Base Wall: Acceptable products are:
  - a. Carlisle:
    - 1) Fire Resist Barritech VP or equal

## 1.5 DESIGN REQUIREMENTS

- A. Perform work in accordance with all federal, state and local codes.
- B. Physical properties (Foam Core):
  1. Water Absorption: ASTM C 209, less than 0.05 percent by volume.
  2. Compressive Strength: ASTM D 1621; Type I; Grade 1. 16 psi (110 kPa) minimum; Grade 2, 20 psi (138 kPa) minimum and Grade 3, 25 psi (172 kPa).
  3. Dimensional Stability: ASTM D 2126, 2 percent linear change (7 days).
  4. Moisture Vapor Permeance: ASTM E 96, less than 0.05 perm (2.875ng/(Pa•s•m2)).
  5. Service Temperature: Minus 100 degrees to 250 degrees F (Minus 73 degrees C to 122 degrees C).
- C. Physical properties (Foam Core) (Class A):
  1. Flame Spread Index: ASTM E 84, less than 25.
  2. Smoke Developed: ASTM E 84, less than 250.
  3. Compressive Strength: ASTM D 1621; Type I, Grade 3 - 25 psi (172 kPa).
  4. Dimensional Stability: ASTM D 2126, 2 percent linear change (7 days).
  5. Moisture Vapor Permeance: ASTM E 96, less than 0.04 perm (2.875ng/(Pa•s•m2)).
  6. Water Absorption: ASTM C 209, less than 0.05 percent by volume.
  7. Service Temperature: Minus 100 degrees to 250 degrees F (Minus 73 degrees C to 122 degrees C).
  8. Air Permeance of Building Material: ASTM E 2178, less than 0.001 L(s.m2) at 75 Pa
  9. Air Leakage of Air Barrier Assemblies: ASTM E 2357, no leakage
  10. Rate of Air Leakage: ASTM E 283, less than 0.04 cfm/ft2
  11. Structural Performance by Uniform Static Air Pressure Difference: ASTM E 330, less than 0.04 cfm/ft2
  12. Water Penetration by Static Air Pressure Difference: ASTM E 331, pass, no leakage
  13. Resistance to Mold: ASTM D 3273 Passed (10).
  14. Impact Resistance: ASTM D 1037, 40 Janka Ball Test.
- D. Continuous Insulation XCI Foil wall panels shall meet the continuous insulation standards of ASHRAE 90.1-2010, IECC 2012 and IBC Chapter 26
- E. Continuous insulation Xci Foil (Class A) wall panels shall meet the continuous insulation standards of ASHRAE 90.1-2010, ICB Chapter 26 and IECC 2012.

- F. Hunter Panels XCI Foil evaluated and listed under ESR-3174. Tests includes the following:
  - 1. Foam core flame spread index of 75 or less and smoke developed of 450 or less when tested in accordance with ASTM E 84 or UL 723.
  - 2. Classified as Type I in accordance with ASTM C 1289.
  - 3. DRJ Technical Evaluation Report #1402-02.
- G. Hunter Panels XCI Foil evaluated and listed under Miami Dade Product Control – Notice of Acceptance NOA No. 14-0501.01
- H. Xci Foil (Class A) wall panels shall be listed by the California Bureau of Furnishings and Home Insulation.

#### 1.6 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Manufacturer's data sheets on wall panels and fasteners to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Manufacturer's Certificate: Certify panels will conform to specified performance requirements.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be a company that regularly manufactures and assembles specified insulation in house with no outside fabrication operations.
- B. Pre-Installation Meeting: Convene minimum one week prior to commencing Work of this section. Review installation procedures and coordination required with Related Work and include the following:
  - 1. Participants: Authorized representatives of the Contractor, Architect, Installer, and Manufacturer.
  - 2. Review wall assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
  - 3. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturer's installation guidelines.
  - 4. Review firestopping requirements and weather resistive membrane requirements and placement locations.
  - 5. Review field quality control procedures.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Good construction practice dictates that all insulations should be protected from moisture and direct sunlight during job-site storage. Pallets of Hunter Panels Xci CG are double packaged in a UV resistant polyethylene bag. This moisture resistant package is designed for protection from the elements during flatbed shipment from our factories to



the job-site. Outdoor storage for extended periods of time requires waterproof tarpaulins and elevated storage above ground level a minimum of 2". Additionally, we recommend slitting the bundle packaging vertically down the center of the two short sides to prevent moisture accumulation within the package.

## 1.9 SEQUENCING

- A. Coordinate with the installation of air barrier specified in Section 072726.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

## 1.10 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Insulating panels shall be XCI products produced by Hunter Panels, 15 Franklin Street, Portland, Maine 04101. Phone: (207) 761-5678 or (888) 746-1114. Fax: (717) 960-1611. E-mail: info@hpanels.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 012500

### 2.2 BOARD INSULATION

- A. Board Insulation with Foil Facer: Hunter Panels XCI Foil complies with ASTM C 1289. Panels are a high thermal resistive rigid insulation panel composed of a closed cell polyisocyanurate foam core bonded to an impermeable foil facer.
  - 1. Type: ASTM C 1289, Type I
    - a. Grade 1 (16 psi).
    - b. Grade 2 (20 psi).
    - c. Grade 3 (25 psi).
  - 2. Panel Size:
    - a. 4 feet by 8 feet.
  - 3. Thickness / R Value: ASTM C 518 at 75 degrees F (23.9 degrees C).
    - a. 1.0 inches / R Value 6.5
    - b. 1.5 inches / R Value 10.0
    - c. 2.0 inches / R Value 13.3
    - d. 2.5 inches / R Value 17.0
    - e. 3.0 inches / R Value 20.3
    - f. 3.5 inches / R Value 24.0
    - g. Provide to the thickness indicated on the Drawings.
- B. Board Insulation with Foil Facers: Hunter Panels Xci Foil (Class A) complies with ASTM C 1289 and ASTM E 84 Class A. Panels are a high thermal resistive rigid insulation panel

composed of a closed cell polyisocyanurate foam core bonded on both sides to reinforced foil facers.

1. Type: ASTM C 1289, Type I
  - a. Grade 3 (25 psi).
2. Panel Size:
  - a. 4 feet by 8 feet.
3. Thickness / R Value: ASTM C 518 at 75 degrees F (23.9 degrees C).
  - a. 1.0 inches / R Value 6.3
  - b. 1.5 inches / R Value 9.5
  - c. 1.6 inches / R Value 10.1
  - d. 2.0 inches / R Value 13.0
  - e. 2.5 inches / R Value 16.0
  - f. 3.0 inches / R Value 19
  - g. 3.5 inches / R Value 22
  - h. 4.0 inches / R Value 25.2
  - i. Provide to the thickness indicated on the Drawings.

## 2.3 PANEL FASTENERS

- A. Panel fasteners shall be corrosion resistant type as approved Hunter Panel fasteners. Length of fasteners shall be as recommended by the panel manufacturer

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until exterior walls have been properly prepared.
- B. Verify that all exterior wall assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that mechanical and electrical services in walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.
- D. If wall assembly preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in exterior spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- E. Exposed insulation must be protected from open flame and stored in accordance with manufacturer's instructions.
- F. Fasten insulation to the structural base wall. Coordinate with the cladding or wall finish manufacturer for the attachment requirements over insulation panels. Contact Hunter Panels for guidance when determining fastening pattern.
- G. Install air barriers as specified in Section 072726.
- H. Exterior wall insulation is not intended to be left exposed for extended periods of time in excess of 45-60 days without adequate protection. If extended exposure is anticipated all exposed foam surfaces including corners, window and door openings, should be taped with a compatible waterproof tape.
- I. Install exterior cladding as recommended by the cladding manufacturer and as specified in other sections of this specification.

#### 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
- C. Do not leave panels exposed to moisture. Wet panels shall be removed or allowed to completely dry prior to application of vapor barrier and/or roof covering.
- D. Wet panels shall be allowed to completely dry prior to application of vapor barrier and/or cladding.
- E. Repair or replace damaged products before Substantial Completion.

END OF SECTION 072113



## SECTION 072726 – AIR BARRIERS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. A 40-mil thickness fluid-applied vapor-permeable membrane of synthetic polymer, fire retardant composition for use as an air and water resistive barrier in exterior walls.
- B. Monolithic, fully-adhered membrane and accessory products installed as a continuous air and water resistive barrier assembly over substrates of the Project's opaque walls as indicated on Drawings
- C. Air and water resistive barrier assembly providing air and water tight coverage over these conditions
  - 1. Joints between building materials such as sheathing joints, mortar joints and dissimilar materials.
  - 2. Joints around windows, curtain walls, louvers, door frames and other service openings
  - 3. Junctions between walls and floors, between walls at building corners and between walls, roofs and ceilings.
  - 4. Mechanical and electrical penetrations
  - 5. Structural penetrations for canopies, decks, walkways and similar horizontal projections or junctions to the exterior walls
  - 6. Fastener and hardware penetrations used to attach insulation, cladding, trim or other overburden
  - 7. Termination at footing, roof deck and existing construction
  - 8. Junction to air & water barrier in roof, below grade or other adjacent systems
- D. Air and water resistive barrier assembly providing air and water tight coverage while accommodating designed movement at expansion and control joints.
- E. Air and water resistive barrier assembly performing as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration

#### 1.02 RELATED SECTIONS

- A. Section 033000 - Cast-In-Place Concrete
- B. Section 042000 - Unit Masonry
- C. Section 079000 - Joint Protection: Joint sealant materials and installation.
- D. Section 092900 - Gypsum Sheathing: Gypsum sheathing over metal studs.

#### 1.03 REFERENCES

- A. American Association of Textile Chemists and Colorists (AATCC) Test Method 127. "Water Resistance – Hydrostatic Pressure Test"
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 "Energy Standard for Buildings Except Low-Rise Residential Buildings"
- C. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
- D. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
- E. ASTM C 1522 Standard Test Method for Extensibility after Heat Aging of Cold, Liquid-Applied Elastomeric Waterproofing Membrane
- F. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection.
- G. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- H. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- I. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.
- J. ASTM E 783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- K. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
- L. ASTM E 1354 Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
- M. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- N. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- O. Canadian General Standards Board (CGSB) 71-GP-24M Standard for: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation
- P. International Code Council Evaluation Services (ICC-ES) Acceptance Criteria for Water Resistive Coatings used as Water Resistive Barriers over Exterior Sheathing AC-212, Approved February 2015
- Q. National Fire Protection Association (NFPA) 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Installed product and accessories shall exhibit an air leakage rate, infiltration and exfiltration modes, measured after pressure cycling, not to exceed 0.2 L/s\*m<sup>2</sup> at 75 Pa [0.040 CFM/ft<sup>2</sup> at 1.57 PSF] according to ASTM E 2357.
- B. Product shall meet the water vapor transmission requirement water resistive coatings used as water resistive barriers: minimum 35 g/m<sup>2</sup>/24h (5 Perms), tested to ASTM E 96 water method (B), ICC-ES AC-212, Section 4.4
- C. For Type I, II, III and IV construction: Installed product and accessories shall be tested to NFPA 285 and pass in wall assemblies of the Project or shall pass by engineering judgement.
- D. Installed product and accessories shall be recommended by manufacturer for at least 180 days of outdoor exposure.
- E. Installed product and accessories shall have an upper service temperature limit of 180°F or higher.
- F. Manufacturer shall provide product and accessories which have a minimum installation temperature of 25°F or lower.
- G. Product shall be of fire-retardant, non-asphalt synthetic polymer composition.
- H. Product shall be minimum 0.040 inch (40 mils) dry thickness membrane. Dry membrane thickness shall be calculated based on field-measured wet mil thickness using a comb gauge and volume % solids of the product. [Example 66% solids membrane applied at minimum 60 wet mils yields a minimum 40 mil thickness membrane].
- I. Product shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance – on Porous Substrate	Not more than 0.02 L/s*m <sup>2</sup> at 75 Pa (0.004 CFM/ft <sup>2</sup> at 1.57 PSF)	ASTM E-2178, mod sprayed on CMU
Air Permeance – Free Film	Not more than 0.02 L/s*m <sup>2</sup> at 75 Pa (0.004 CFM/ft <sup>2</sup> at 1.57 PSF)	ASTM E-2178
Low Temperature Flexibility	No cracking at minus 20 degrees F, 180 degree bend over 1 inch mandrel	ASTM D 1970
Low-Temperature Crack Bridging	No cracking after 10 cycles at minus 15 deg F	ASTM C 1305, mod 40 mil membrane thickness
Long-Term Aging/ Flexibility	No cracking or tearing after aging	ASTM C 1522, mod 40 mil membrane thickness OR CGSB 71-GP-24M
Fastener Sealability	No water leaking through nail penetration after 24 h.	ASTM D 1970
Water Resistance	Product spray-applied to CMU and gypsum sheathing with joint shall resist a 55 cm (22 inch) column of water for 5 hours, no leaking or wet through.	AATCC-127 - mod, static head generated with 5" diameter PVC pipe sealed to specimen

Pull Adhesion	Not less than 16 lb <sub>f</sub> per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit (CMU)	ASTM D 4541, modified 4 inch wood puck
Water Vapor Permeance	Not less than 5 perms	ASTM E-96, Water Method (B)
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, 40 mil dry film, cement board substrate
Measurement of Heat Release Rate by Cone Calorimeter	Effective Heat of Combustion: Not more than 12.3 MJ/kg Total Heat Released: not more than 14.7 MJ/m <sup>2</sup> Peak Heat Release: Not more than 167 kW/m <sup>2</sup>	ASTM E 1354, horizontal orientation, 50 kW/m <sup>2</sup> heat flux

#### 1.05 SUBMITTALS

- A. Provide submittals in accordance with Section 013300.
- B. At bid submission, provide evidence to the Architect of installer qualification by the air barrier manufacturer.
- C. Shop drawings showing locations and extent of air barrier and details of all typical conditions.
- D. Vertical and lateral fire propagation evaluation of the Project's exterior wall assemblies containing the product, submit documentation of one of the following:
  1. NFPA 285 test and pass
  2. NFPA 285 pass through engineering judgement
  3. Exemption from the NFPA 285 requirement.
- E. Manufacturer's technical data sheets and safety data sheets for product and accessories.
- F. Manufacturer's installation instructions.
- G. Certification of compatibility by manufacturer, listing all materials on the project with which the product and accessories may come into contact.
- H. Free film sample of product at representative cured thickness, minimum 2 inch by 3 inch size.
- I. Sample of sheet detail flashing and transition membrane, minimum 2 inch by 3 inch size.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Shall be experienced in applying the same or similar materials and shall be specifically approved in writing by Manufacturer.



- B. Single-Source Responsibility: Obtain product and accessories from single manufacturer.
- C. Product and Accessories shall comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
- D. Pre-Installation Meeting: Convene one (1) week prior to commencing work.
- E. Field-Constructed Mock-Ups: Prior to installation on Project, apply product and accessories on mock-up to verify details under shop drawing submittals, to demonstrate tie-ins with adjoining construction and other termination conditions and to become familiar with properties of materials in application:
  - 1. Construct typical exterior wall panel, 8 feet long by 8 feet wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, building corner condition, junction with roof system foundation wall and typical penetrations and gaps; illustrating interface of materials and seals
- F. Allow full cure of product and test mock-up in accordance with Section 014000 – Quality Requirements and test in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration
- G. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed product unless it has been inspected, tested and approved.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, lot number and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by manufacturer.
- C. During cold weather, protect product in containers and spray equipment from freezing. Maintain product temperature within acceptable range for spray application, as required by air barrier manufacturer.
- D. Avoid spillage. Immediately notify Owner, Consultant if spillage occurs and start cleanup procedures. Clean spills and leave area as it was prior to spill.

#### 1.08 WASTE MANAGEMENT AND DISPOSAL

- A. Separate and recycle waste materials in accordance with Section 017419 – Construction Waste Management and Disposal, and with the Waste Reduction Work Plan.
- B. Place materials defined as hazardous or toxic waste in designated containers.
- C. Ensure emptied containers are stored safely for disposal away from children.

#### 1.09 PROJECT CONDITIONS

- A. Do not apply product or accessories during rain or accumulating snowfall.

- B. Apply product and accessories within approved ambient and substrate temperature range stated in manufacturer's literature.
- C. Do not apply product or accessories over incompatible materials.
- D. Observe safety and environmental measures indicated in manufacturer's SDS, and mandated by federal, state and local regulations.

1.10 WARRANTIES: Provide the manufacturer's minimum five (5) year material warranty.

## PART 2 PRODUCTS

### 2.01 PRODUCTS AND MANUFACTURERS :

- A. Carlisle Coatings & Waterproofing, Incorporated. 900 Hensley Lane, Wylie, TX 75098. Phone 1-800-527-7092. Website <http://www.carlisleccw.com>
  - 1. Fire Resist Barritech VP, for installation at 40 degrees F and above
  - 2. Fire Resist Barritech VP LT, for installation at 15 degrees F and above
- B. [Other manufacturers and products, as approved by Architect]

### 2.02 ACCESSORIES: Provide from same manufacturer as air barrier membrane.

- A. Sheet Detail Flashing: Foil composite faced rubberized asphalt flashing, minimum 0.040 inch (40 mils) thickness.
  - 1. Fire-Resist 705 FR-A or Fire-Resist 705 FR-A LT low temperature application formula by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer
- B. Contact Adhesive:
  - 1. Carlisle Coatings & Waterproofing, Incorporated: CCW-702 Solvent-Based, CCW-702 LV VOC Compliant Solvent-Based, CCW-702 WB Water-Based, CAV-GRIP™ Aerosol Spray or Travel-Tack portable aerosol spray cans
  - 2. Others as approved by air barrier membrane manufacturer
- C. Liquid Detail Flashing. Silane-terminated polyether, minimum 90% solids. ASTM C 920 Type S, Grade NS, Class 25, Use NT. 0.040 inch (40 mil) thickness application
  - 1. Barribond
  - 2. Others as approved by air barrier membrane manufacture
- D. Detail Sealant:
  - 1. Barribond by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer

- E. Transition Membrane:
  - 1. CCW SURE-SEAL Pressure-Sensitive Elastoform by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer
- F. Transition Membrane Primer:
  - 1. Carlisle Coatings & Waterproofing, Incorporated: SURE-SEAL HP-250 Primer, SURE-SEAL EP-95 Splicing Cement or SURE-SEAL Low VOC EPDM Primer
  - 2. Others as approved by air barrier membrane manufacturer
- G. Reinforcing Fabric: Woven, synthetic polymer fabric
  - 1. DCH Reinforcing Fabric by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer
- H. Glass Mat: Randomly-oriented glass strands held in binder soluble in wet air barrier membrane. Offered in rolls of various widths
  - 1. LiquiFiber
  - 2. Others as approved by air barrier membrane manufacturer
- I. Fill Compound: 2-part, non-sag polyurethane sealant
  - 1. Carlisle Coatings & Waterproofing, Incorporated: CCW-703 V or CCW-201
  - 2. Others as approved by air barrier membrane manufacturer

## 2.03 RELATED MATERIALS BY OTHERS

- A. Silicone Sealant, select any:
  - 1. Dow 758, 790, 791, 795
  - 2. Pecora AVB Silicone, 890, 891, 895
  - 3. GE Silpruf, Silpruf LM
  - 4. Other product approved by air barrier membrane manufacturer
- B. Polyurethane Foam Sealant, select any:
  - 1. TVM Fireblock Foam
  - 2. Fomo Handifoam Fireblock
  - 3. Great Stuff PRO or Froth Pack by Dow Chemical Company
  - 4. Other product approved by air barrier membrane manufacturer
- C. Insulation Adhesive, select any

1. Barribond
2. LM 800 XL
3. QB-300 Multi-Purpose Construction Adhesive by OSI
4. PL-300 VOC Foamboard Adhesive by Loctite
5. Other product approved by air barrier membrane and board foam insulation manufacturer

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions affecting installation of the air & vapor barrier and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.
- C. Concrete shall be cured for a minimum of seven days. It shall be smooth, with sharp protrusions such as form joints or fins removed and ground flush. Honeycomb and holes/cracks shall be filled with grout or mortar.
- D. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.
- E. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.
- F. Mortar joints shall be struck flush and shall be free of voids. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.
- G. Sheathing boards shall be flush at joints, with gaps between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.
- H. Plywood, OSB, lumber or pressure-treated wood moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%.
- I. Inform Architect [Consultant] [Owner] in writing of
  1. Unsatisfactory substrates
  2. Cracks in concrete and masonry.
  3. Gaps or obstructions such as steel beams, angles, plates and projections which cannot be spanned or covered by Product or Accessories.
  4. Anticipated problems applying product and accessories over substrate.

### 3.02 SURFACE PREPARATION

- A. Note to Mason: This project will have fluid-applied Membrane Air Barrier material applied to the cavity side of the CMU. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane
  2. The CMU surfaces shall be free from projections.
  3. Strike all mortar joints flush to the face of the concrete block.
  4. Fill all voids and holes with mortar, sealant or other approved fill material.
  5. Surface irregularities shall be ground flush or made smooth.
  6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
  7. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (typically one part cement to three parts sand) over the entire surface to receive Air Barrier Membrane
  8. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.
- B. Fill cracks, gaps and joints with fill compound, detail sealant or other material approved by air barrier manufacturer.
- C. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.
- D. Apply a  $\frac{3}{4}$  inch cant of fill compound or detail sealant at the intersection of the base of the wall and the footing.

### 3.03 DETAILING

- A. Additional materials and installation are required at joints, transitions, openings, terminations, penetrations and similar surface irregularities. Perform detailing before or after product installation.
- B. Install product and accessories in details as directed in manufacturer's literature.
- C. Sheathing joints, use one of the following methods:
1. 4 inch reinforcing fabric imbedded in product and centered over joint.
  2. 2" width liquid flashing centered over joint.
- D. Sheathing inside and outside corners. Flashing or reinforcement shall bear 3 inches minimum onto either side of angle change. Use any of the following methods:

1. Sheet detail flashing
  2. Liquid detail flashing centered over angle change
  3. Reinforcing fabric centered over angle change and imbedded in product
  4. Glass mat centered over angle change and imbedded in product
- E. Window openings. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall return into window opening according to Project drawings. Use any of the following materials:
1. Sheet detail flashing
  2. Liquid detail flashing
  3. Glass mat imbedded in product
- F. Pipe or duct penetrations. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall bear onto pipe or duct 3 inches, or according to Project drawings. Select any:
1. Sheet detail flashing
  2. Liquid detail flashing
  3. Glass mat imbedded in product
- G. Expansion or deflection joints. Flashing shall bear 3 inches minimum onto either side of joint. Select any:
1. Sheet detail flashing bellows or expansion bulb
  2. Transition membrane expansion bulb
- H. Interface of dissimilar substrates: Flashing or reinforcement shall bear 3 inches minimum onto either side of joint. Select any:
1. Sheet detail flashing
  2. Liquid detail flashing
  3. Reinforcing fabric imbedded in product
  4. Glass mat imbedded in product
- I. Seal all terminations of sheet detail flashing with a 1 inch width X 0.040 inch (40 mils) thick ribbon of detail sealant, centered over termination.

### 3.04 INSTALLATION

- A. Apply product and accessories over opaque wall surfaces as indicated in Project drawings.
- B. Use the manufacturer's standard or low temperature formula product as required by the project conditions.

- C. Apply product by spray, roller, brush or other method as recommended by air barrier manufacturer. Apply product at specified wet mil thickness in accordance with air barrier manufacturer's requirements.
- D. Verify compliance with air barrier manufacturer's minimum required thickness by documenting product use per area. Perform and document wet mil thickness measurements every 100 square feet, or more frequently if required, to establish uniform and adequate coverage.
- E. Installation shall produce complete coverage of opaque substrates as indicated in Drawings.
- F. Product and accessories shall be fully-adhered to substrates. Defects such as holes, fishmouths, blistering, de-lamination, bridging or thin spots shall be repaired according to air barrier manufacturer's instructions.

### 3.05 SCHEDULE

- A. Wall substrates and roof or temporary roof shall be in place, effectively enclosing interior space, before proceeding with air barrier installation.
- B. Seal penetrations made through installed product according to manufacturer's instructions and drawings.
- C. Seal fenestration to product with detail membrane, transition membrane, detail sealant, silicone sealant or polyurethane foam sealant according to Project drawings
- D. Through-wall flashing may be installed before or after product. Seal termination of through-wall flashing to product according product manufacturer's instructions.
- E. Exterior cladding shall be installed after product.
- F. Rigid or semi-rigid insulation installed over product shall be attached with mechanical fastening, insulation adhesive or a combination of these techniques, according to insulation manufacturer and air barrier manufacturer's instructions.
- G. Sequence Work to enable air barrier continuity at wall-to-foundation, shelf angle, wall-to-roof, fenestration, different wall assemblies and other conditions as indicated in Project drawings.

### 3.06 REPAIR AND PROTECTION

- A. Protect from damage during application and remainder of construction period.
- B. Inspect and make necessary repairs before covering. Repair or replace damaged material according to manufacturer's literature.
- C. Product and accessories are not designed for permanent exposure. Cover with insulation or exterior cladding as soon as schedule allows.
- D. Outdoor exposure of installed product and accessories shall not exceed 180 days.

END OF SECTION 072726





## SECTION 075600 – FLUID-APPLIED ROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - a. New Construction:
    - 1) Glass ply mechanically fastened to light weight deck over metal pan.
    - 2) Polyisocyanurate insulation R-30 adhered in low rise foam insulation adhesive.
    - 3) ¼" tapered insulation adhered in low rise foam adhesive.
    - 4) 1/2" reinforced gypsum cover board adhered over polyisocyanurate insulation in low rise foam insulation adhesive.
    - 5) One trilaminate base ply adhered in dual component cold process adhesive.
    - 6) Dual component 100% solids reinforced fluid-applied roofing and flashing system, cold applied.
    - 7) Slip-resistant walkway areas.
    - 8) Metal perimeter flashings, counter flashings, components and miscellaneous accessories as required.

#### 1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Flashings and Fastening: Comply with requirements of Division 07 Sections "Sheet Metal Flashing and Trim" and "Roof Specialties." Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
  - 1. FMG 1-49: Loss Prevention Data Sheet for Perimeter Flashings.
  - 2. FMG 1-29 (rev. 1-06): Loss Prevention Data Sheet for Above Deck Roof Components.
  - 3. NRCA Roofing and Waterproofing Manual (Fifth Edition) for construction details and recommendations.
  - 4. SMACNA Architectural Sheet Metal Manual (Fifth Edition) for construction details.
  - 5. The metal edge securement, except gutter, shall be installed as tested in accordance with the most current version of the ANSI/SPRI ES-1, American National Standard for Edge Systems Used with Low-Slope Roofing Systems.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Tapered insulation layout, including thicknesses and slopes.
  - 2. Base flashings and membrane terminations.
  - 3. Crickets, saddles, and tapered edge strips, including slopes.
- C. Samples for Verification: For the following products:
  - 1. 8-by-10 inch sample of trilaminate base ply.
  - 2. 4-by-4-inch of roof insulation and cover board.
  - 3. Six insulation fasteners of each type and length.
  - 4. Six base sheet fasteners of each type and length.
  - 5. 1-by-3-inch sample of cured fluid-applied system (base coat/reinforcement/top coat).

## 1.6 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that fluid-applied roofing complies with requirements specified in "Performance Requirements" Article.
  - 1. Provide copies of FM RoofNav approval assemblies and/or UL TGFU & TGIK wind uplift and fire rating assemblies showing approved substitutions.
- C. Qualification Data: For manufacturer's technical representative.
- D. Warranties: Sample of warranties as specified in this Section.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing cold process roofing systems; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive and issue the roofing manufacturer's warranty.
  - 1. Applicators to include a list of projects, completed within the last three (3) years of, similar size, and within 50 miles of project site using the submitted manufacturer's cold applied roofing products. Include names and addresses of Architects and Owners, and other information with bid.
- B. Installing contractor shall not own the roofing materials manufacturer, shall not be owned by the roofing materials manufacturer, and shall not be a subsidiary of or with the roofing materials manufacturer.
- C. Manufacturer Qualifications: Manufacturer shall demonstrate a minimum (10) ten-year track record of successful production and application of cold process roofing systems. Include names and addresses of architects and owners, and other information as needed.
- D. Source Limitations: Roofing membrane plies, base flashings and insulation adhesive materials to be supplied by a single manufacturer with said products branded by the single manufacturer issuing the roofing warranty. Auxiliary materials to be approved by roofing system manufacturer.

- E. Inspection Reports: Provide copies of the roofing system manufacturer's inspection reports noted during and at the completion of the new roof installation. Manufacturer's Technical (non-sales) Representative must inspect roof installation every other day and report progress to Owner's representative. Provide progress photos for application of each operation of roofing system. In addition to regular inspections, Manufacturer's Technical (non-sales) Representative shall be present for roof work starts at each section. Manufacturer's Technical Representative shall provide proof of no less than 10 years experience in the Roofing Industry.
- F. Roofing Inspections: Arrange for roofing inspections by roofing system manufacturer's technical personnel as required in Part 3 Article "Field Quality Control."
- G. Roofing Inspector Qualifications: A full time technical representative of manufacturer (non-sales) experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification.
  - 1. The Roofing Inspector shall be one of the following:
    - a. An authorized full-time technical employee of the manufacturer with 10 years experience in commercial roofing.
    - b. If manufacturer does not employ full time technical personnel, inspection personnel shall be certified as a Registered Roof Observer by the Roof Consultants Institute and shall be experienced in the installation and maintenance of the specified roofing system and qualified to determine Installer's compliance with the requirements of this Project.
- H. Provide installer's field supervision. Installer must maintain full-time supervisor/foreman on job-site during times that roofing work is in progress. Supervisor must have a minimum of 5 years experience in roofing work similar to nature and scope of specified roofing.
- I. Source Limitations: Obtain roofing system components from or approved in writing by roofing system manufacturer.
- J. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
  - 1. Exterior Fire Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
  - 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
- K. Pre-Bid Roofing Conference: Conduct conference at Project site.
- L. Pre-installation Roofing Conference: Conduct conference at Project site. Combine with preliminary roofing conference specified in Division 07 Section "Preparation for Reroofing".
  - 1. Meet with Owner, Architect, inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review status of required submittals.
  - 5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  - 6. Review structural loading limitations of roof deck during and after roofing.

7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.
- E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- F. Contractor is responsible for the safekeeping of materials stored onsite.

#### 1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Prevent dust, vapors, gases, and odors from entering into the building during roof installation. When shutting down or blocking air intakes, provide makeup air or additional intake air from sources away from the work area. Coordinate these procedures with owner's Representative.

#### 1.10 WARRANTY

- A. Manufacturer's Roofing Warranty: Submit a written warranty, signed by the roofing system manufacturer agreeing to promptly repair any leaks in the roof membrane system resulting from defects in materials or workmanship including, but not limited to, roof plies and adhesive, base flashings, roof insulations and adhesives, wood components, fasteners, and all roof system metal components for the indicated warranty period.
  1. Manufacturer's 25-Year Systems Warranty.
  2. Indicate a wind speed warranty of 74 M.P.H., as reported by the certified weather reporting station nearest to the site for the Mamaroneck, N.Y. region. Provide a sample copy of standard roofing manufacturer's warranty, stating obligations, remedies, limitations, and exclusions of warranty.

3. Bidders to provide copy of the manufacturer's sample warranty, written as specified, with bid.
  4. Inspections required by the manufacturer to provide this warranty shall be performed at no additional cost to the Owner.
  5. Warranty shall run for a continuous 25 years.
  6. Warranty will not be accepted that contains any requirement(s) for Owner to renew the warranty at any time during the 25 year period.
  7. In year(s) number 2, 5, 10, 15 and 20 of this warranty, manufacturer shall provide roof inspections, and limited housekeeping services, at no additional charge.
  8. Upon successful completion of the work and prior to receipt of final payment, the manufacturer's warranty as stated above shall be issued to the Owner.
- B. Applicator/Roofing Contractor Warranty: Submit roofing installer's written warranty, signed by the installer, covering work of this section, including but not limited to, roof plies and adhesive, insulation layers, base flashings, roof insulations, wood components, fasteners, and all roof system metal components for two years from the date of substantial completion. The warranty shall guarantee material and workmanship for watertightness, weathertightness, and against all leaks. During the two-year period, the contractor shall respond and fix all reported leaks within 24 hours from time of notification, and fix all leaks without any cost to the Owner.
1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer/Product: The roof system specified in this Section is based upon Tremco, Inc. products named in other Part 2 articles. Subject to compliance with requirements, provide the named product by one the following:
1. Tremco, Alphaguard Bio Inc. (Basis of Design System)
  2. Kemper 2KPUR
  3. Pacific Polymers.
  4. Architect-approved equal.
- B. Approved Manufacturer's trillaminate base sheet and solvent free adhesive:
1. Manufacturer / VB Trillaminate Base Sheet / Adhesive
    - a. Tremco Inc. / BURmastic Composite Ply HT / Powerply Endure
- C. Approved Manufacturer's Fluid-Applied Roofing Products:
1. Manufacturer / Base Coat / Reinforcement / Top Coat
    - a. Tremco Inc. / AlphaGuard Bio Base Coat / AlphaGuard Permafab / AlphaGuard Bio Top Coat
- D. Reinforced fluid-applied roofing systems shall be dual component system employing aromatic 100% solids polyurethane base coat, full reinforcement and an 100% solids aliphatic polyurethane top coat. Moisture-cured, polymethyl-methacrylate (PMMA), MMA and aromatic polyurethanes are not permitted.

### 2.2 AUXILIARY ROOFING MEMBRANE MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- B. Base Ply Sheet: Non-perforated, asphalt-coated, fiberglass/fiberglass/polyester, or polyester/fiberglass/polyester trillaminate-reinforced sheet dusted with fine mineral surfacing on

both sides which meets the requirements of ASTM D 4601, Type II, and the following properties per ASTM D5147:

1. Tensile Strength, minimum, ASTM D 5147: machine direction, 140 lbf/in; cross machine direction, 130 lbf/in.
  2. Tear Strength, minimum, ASTM D 5147: machine direction, 220 lbf; cross machine direction, 185 lbf.
  3. Thickness, minimum, ASTM D 5147: 55 mils.
- C. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with specified roofing system.
- D. Polyurethane sealant suitable for sealing at penetrations, cracks and providing a suitable transition between walls and roof prior to the installation of the membrane system.
1. Tremco, TremSeal D Sealant, or equal as approved by roofing manufacturer.
- E. Metal & PVC Pipe Surface Primer: M-Prime, single-component, water based primer to promote adhesion of base coat to metal and PVC pipe surfaces.
- F. Surfaces Re-Primer: Geogard Primer, Single-component, multi-substrate primer to promote adhesion of base coat to aged coated surfaces.
- G. Masonry Primer: C-Prime, dual-component, masonry primer to promote adhesion of base coat to masonry surfaces.
- H. Asphalt Primer: Manufacturer's water based asphalt primer.
- I. Solvent-Free Elastomeric Mastic: One-part, asbestos-free, elastomeric roof mastic specially formulated for compatibility and use with specified roofing membranes and flashings, with the following properties:
1. Asbestos Content, EPA 600/R13/116: None.
  2. Elongation at 77 deg. F, minimum, ASTM D 412: 220 percent.
  3. Tensile Strength, 270 psi.
- J. Drain Flashings: 4lb lead sheet.
- K. Slip-Resistant Walkway Additive: Silica/Quartz Sand.
- L. Miscellaneous accessories as required by manufacturer.

## 2.3 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses required.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, HCFC-free, with felt or glass-fiber mat facer on both major surfaces.
- a. R-Value minimum continuous R-30.
  - b. Tapered slopes as indicated on drawings.

## 2.4 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

- B. Insulation Adhesive: Two-component, solvent-free, low odor, elastomeric urethane adhesive formulated to adhere roof insulation to substrate, with the following physical properties:
  - 1. Flame Spread Index, ASTM E 84: 10.
  - 2. Smoke Developed Index, ASTM E 84: 30.
  - 3. Asbestos Content, EPA 600/R13/116: None.
  - 4. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 0 g/L.
  - 5. Tensile Strength, minimum, ASTM D 412: 250 psi.
  - 6. Peel Adhesion, minimum, ASTM D 903: 17 lbf/in.
  - 7. Flexibility, 70 deg. F, ASTM D 816: Pass.
- C. Wood Nailers and Cants: Comply with recommendations in FMG Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants. Fibrous cants are not permitted.
- D. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
- E. Provide preformed crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain.
  - 1. Cricket and saddles to have a minimum of double the slope of the insulation.
  - 2. Adhered crickets to be installed between all drains.
- F. Cover Board: Reinforced gypsum cover board to be:
  - 1. USG Corporation; Securock: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/2 inch thick.

## 2.5 METAL FLASHING MATERIALS

- A. See Division 07 Section "Sheet Metal Flashing and Trim" for custom metal roof penetration flashings, counter flashings and perimeter flashings.
- B. Other Metal Flashings:
  - 1. Metal flashings, counter flashings, pitch pans, scuppers, and like applications shall be in accordance with:
    - a. National Roofing Contractors Association Manual (NRCA).
- C. Pitch pans and hoods:
  - 1. 16 ounce copper, mill finish. Soldered joints.
- D. Lead Flashings: Plumbing Stacks and Drain Bowls: 4 lb. sheets ASTM B29-79
- E. Termination Bar: Extruded aluminum bar x 2" wide x 10' lengths. Fastener spacing 8" o.c.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
  - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
  - 4. Verify that substrate is visibly dry and free of moisture.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. All roof top curbs, units, projections and wall flashings must be raised to allow finish roof system flashing height of eight inches.
- B. Remove all existing roofing, insulations, flashings and perimeter metal flashings down to roof deck.
- C. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- D. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- E. Prevent dust, vapors, gases, and odors from entering into the building during roof installation. When shutting down or blocking air intakes, provide makeup air or additional intake air from sources away from the work area. Coordinate these procedures with owner's Representative.

### 3.3 INSTALLATION, GENERAL

- A. Install roofing system in accordance with manufacturer's recommendations.
- B. Begin the built up roof membrane system installation in the presence of roofing manufacturer technical (non-sales) personnel.
- C. Coordinate installation of roofing system components so insulation and roofing plies are not exposed to moisture or remain exposed at the end of the workday or when rain is forecast.
- D. Provide water cutoffs at the end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
- E. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system.
- F. Roofing system and building shall be water-tight at the end of each working day.
- G. Remove and discard temporary seals before beginning work on adjoining.
- H. Shingling Plies: Install base sheet and roofing plies with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water.
- I. Cooperate with inspecting and testing agencies engaged or required to perform services for installing modified bitumen membrane roofing system.
- J. Asphalt Primer Application: Prime all surfaces and substrates to which cold adhesive or asphalt mastic or membrane will come in contact. Apply at the rate of 200 square feet per gallon. Coat all metal flashings and fascia with primer that will come in contact with membrane materials.
- K. Install roofing system in accordance with NRCA Manual Plates and NRCA recommendations; modify as required to comply with requirements of FMG references above.



- L. Contractor shall erect all required roof barriers and safety lines as required by OSHA and comply with OSHA regulations for safety.

### 3.4 ROOF DRAINS

- A. General:
  - 1. Inspect roof drains at time of existing roof tear-off to ascertain requirements for repair and/or replacement of broken or missing parts.
  - 2. Provide temporary means of protecting roof drains from clogging of foreign material during construction. (E.g. inclement weather, weekends, holidays, etc.)
- B. Preparation:
  - 1. For all existing roof drain locations, remove all foreign material from body of drain, tailpiece, connecting piping, and roof leader.
  - 2. Flush through roof leaders to building drainage system to remove sediment and to test drain capacity.
  - 3. Verify that all roof drains are clear and free flowing and attain Owner's site representative approval prior to commencement of work.
- C. Rework Roof Drains:
  - 1. Clean drain body of all bitumen and other contaminants.
  - 2. Set drain bowl to required height to allow for proper drainage and meet manufacturer's insulation requirements at drain.
  - 3. Fasteners: Coat all bolt threads with manufacturer's recommended permanent type lubricant to prevent freeze-up.
  - 4. Set membrane under new clamping ring in full bead of water stop mastic.
  - 5. Use bronze, brass or stainless steel machine bolts.
  - 6. Do not seal the new dome strainer to the drain body or clamping ring. It must be removable for future cleaning of the drain bowl or roof leader.
  - 7. Install new cast iron drain strainers. Plastic strainers are not permitted.

### 3.5 BASE SHEET INSTALLATION ON LIGHT WEIGHT DECK

- A. Install one lapped base sheet course and mechanically fasten to light weight substrate to meet wind uplift requirements, according to built-up roofing manufacturer's written instructions.

### 3.6 INSULATION INSTALLATION

- A. Comply with roofing manufacturer's written instructions for installing roof insulation.
- B. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- C. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- D. Install tapered insulation and crickets, as indicated on drawings, to provide positive drainage.
- E. Install insulation with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- F. Install wood nailers to match insulation and cover board thicknesses. Attach to deck per FM 1-49.

- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/8 inch with insulation.
  - 1. Cut and fit insulation within 1/8 inch of nailers, projections, and penetrations.
- H. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring and does not restrict flow of water.
- I. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- J. Taper insulation to provide 1/8" with a 48" square sump at roof drains.
- K. Provide adhered crickets between drain locations and adhered saddles along walls between drains to ensure positive drainage.
- L. Adhered insulation: Set all insulation layers in ribbons/beads of specified insulation adhesive at the rate required by the manufacturer to meet the minimum field wind uplift pressures. Firmly press boards into place following manufacturer's written instructions.
  - a. Increase adhesive application rate by 50% in roof perimeters and 75% in roof corners.

### 3.7 COVER BOARD INSTALLATION

- A. Install cover boards over all insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together. Prime all non-factory-primed gypsum cover boards with asphalt primer and allow primer to dry.
  - 1. Set cover board in ribbons of the specified cold-applied insulation adhesive the rate required by the manufacturer to meet required wind uplift pressures. Firmly press boards into place following manufacturer's written instructions.
    - a. Increase adhesive application rate by 50% in roof perimeters and 75% in roof corners to meet specified wind uplift.
- B. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

### 3.8 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in NRCA's "Quality Control Guidelines for the Application of Fluid Applied Roofing".
- B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
- C. Cooperate with inspecting agencies engaged or required to perform services for installing roofing system.
- D. Coordinate installation of roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
  - 1. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
  3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Substrate-Joint Penetrations: Prevent roofing adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

### 3.9 BASE PLY INSTALLATION

- A. Install trilaminate base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align base-ply sheets without stretching. Extend sheets over and terminate.
1. Shingle 4 inch minimum side laps of trilaminate base-ply sheets uniformly. Shingle in direction to shed water.
  2. Embed trilaminate ply sheet in cold-applied dual component adhesive applied at a minimum rate of 2.00 gallons per 100 square feet.
  3. Completely bond and seal all laps, leaving no voids, fish-mouths or mole-runs.
  4. Broom ply into adhesive to ensure a positive bond.
  5. Extend adhered base ply down over face of perimeter wood blocking and fasten base ply 12 inches on center.
  6. At walls and penetrations, seal with a three-course application of elastomeric mastic and mesh where base ply meets a vertical transition or penetration.
- B. Allow solvent-free adhesive bleed-out at laps, and sealant/mastic at walls and penetrations, to skin over before beginning fluid-applied base coat installation.

### 3.10 REINFORCED FLUID APPLIED FLASHING INSTALLATION

- A. Reinforced fluid-applied flashings are to be installed before field-of-roof installation occurs.
- B. Fluid-applied material thicknesses listed herein are minimum application rates and may be required to be increased depending on the manufacturer's requirements to meet the specified warranty period.
- C. Install flashings a minimum of eight inches up vertical surfaces, or as shown on details, and extend four inches onto horizontal surfaces.
- D. Install painters tape where flashings end on walls or other termination points. Ensure removal of tape immediately after each coating application. If coating cures while tape is still installed, removal may be impossible.
- E. Prime flashing substrates with appropriate primer according to manufacturer's written instructions.
1. Apply using short nap roller, squeegee, brush or airless spray. Ensure primer does not puddle and substrate has complete coverage.
  2. Base coat may be applied once primer is dry and tack free.
- F. Install three course of elastomeric mastic and mesh at roof-to-penetration intersections. Allow mastic to skin over before proceeding with polyurethane flashings.
- G. Prime all surfaces with appropriate primer before applying base coat.
- H. Reinforced Flashing Base Coat: properly mix and pour base coat at a rate of three (3.0) gallons per 100 square feet.

1. Back roll base coat evenly to vertical and horizontal primed areas, brush apply on small round vertical applications, to achieve a wet film thickness of 48 mils minimum.
  2. Apply base coat to flashings extending base coating up vertical surfaces and out onto horizontal surfaces four inches.
  3. Embed fabric into wet base coat. At pipe and post penetrations install a wagon wheel of fabric and embed into wet base coat, then install square target sheet of mesh over wagon wheel. Ensure all mesh is fully encapsulated in the base coat material.
  4. Cure times are extended at temperatures below 60 degrees F.
- I. A thorough inspection by manufacturer's technical inspector must take place before the top coat is applied. There shall be no bare spots, no holidays, no skips, no exposed mesh, and no pinholes prior to application of the top coat. If there is no written record of this inspection, no warranty will be issued.
- J. Flashing Top Coat: Apply top coat after base coat cures, but within 72 hours of the initial base coat application.
1. Prime base coat prior to application of top coat if top coat is not applied within 72 hours of the base coat application, using manufacturer's recommended re-primer.
  2. Pour finish coat directly onto roof surface after mixing and spread top coat over reinforced base coat, evenly, at a rate of three (3.0) gallons per 100 square feet minimum.
  3. Back roll to achieve a minimum wet film thickness of 48 mils.
    - a. Surface temperature and condition may affect the actual coverage. Cure times are extended at temperatures below 60° Fahrenheit.
  4. Apply top coat to flashings extending top coating up vertical surfaces and out onto horizontal surfaces 6 inches.
  5. Do not allow weather conditions to ruin the quality or uniformity of the coating.
  6. Avoid foot traffic on new coating for a minimum of 24 hours.
- K. Install new counter flashings to cover base flashing terminations and fasten 12" o.c.
1. End lap flashings minimum of 3 inches.
  2. Fold corners and hem all exposed edges to ensure no sharp edges are exposed.
  3. Break counter flashing to return snugly against the fluid-applied wall flashings.
- L. Roof Drains: Install primed four pound lead flange in bed of base coat over installed base ply. Cover primed lead flashing with reinforced base coat stripping extending a minimum of 6 inches beyond edge of metal flashing onto base ply. Install reinforced base coat and top coat down one inch into primed drain bowl. Clamp roof membrane, metal flashing, and stripping into roof-drain clamping ring.
- 3.11 REINFORCED FLUID-APPLIED FIELD MEMBRANE APPLICATION
- A. Fluid-applied material thicknesses listed herein are minimum application rates and may be required to be increased depending on the manufacturer's requirements to meet the specified warranty period.
- B. Reinforced Membrane Base Coat: properly mix and pour base coat at a rate of three (3.0) gallons per 100 square feet in accordance with manufacturer's written instructions. Back roll to achieve minimum wet mil coating thickness of 48 mils, or more as required by manufacturer; verify thickness of base coat as work progresses with a wet film gauge.
1. Apply base coat on prepared and primed surfaces and spread coating evenly.
  2. Embed fabric reinforcement into wet base coat. Lap adjacent flashing pieces of fabric minimum three inches along edges and four inches at end laps.
  3. Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

4. Cure times are extended at temperatures below 60 degrees F. Moisture-triggered polyurethanes, as specified, use moisture in the air to kick off the curing process. Cold, dry air will slow this process, resulting in extended cure times. It may be necessary to allow an additional day between applying the base and top coats.
  5. Allow base coat to cure prior to application of top coat.
- C. A thorough inspection by manufacturer's technical inspector must take place before the top coat is applied. There shall be no bare spots, no holidays, no skips, no exposed fabric, and no pinholes prior to application of the top coat. If there is no written record of this inspection, no warranty will be issued.
- D. Membrane Top Coat: Apply top coat uniformly to provide a neat and completely covered installation over field of roof and flashings.
1. Prime base coat prior to application of top coat if top coat is not applied within 72 hours of the base coat application, using manufacturer's recommended re-primer.
  2. Pour top coat at a rate of three (3.0) gallons per 100 square feet after properly mixing, or more in accordance with manufacturer's written instructions.
  3. Back roll to achieve minimum wet mil coating thickness of 48 mils, or more as required by manufacturer; verify thickness of base coat as work progresses with a wet film gauge.
  4. Avoid foot traffic on new fluid-applied membrane for a minimum of 72 hours in weather below 60 degrees.

### 3.12 ROOF WALKWAY AREAS

- A. After initial fluid-applied top coat has cured, at indicated areas:
1. Install second application of top coat at a rate of 1.0 gallons (16 wet mils) per 100 square feet.
  2. Broadcast mesh silica sand or quartz at the rate of 15-20 lbs per 100 square feet into wet top coat.
  3. Immediately back roll sand and top coat, creating an even dispersal of sand.
  4. Remove tape outlining walkway area immediately while coating is still wet.
  5. Remove any loose sand from cured roofing surface.
  6. Avoid foot traffic on walkway areas for a minimum of 72 hours.

### 3.13 FIELD QUALITY CONTROL

- A. Manufacturer's Technical Representative must inspect roof installation every other day, on days where roofing work is taking place, and report progress to Owner's representative.
- B. To ensure roofing inspections are not missed or overlooked, the installing contractor shall notify the roofing manufacturer's technical inspector by phone, each and every morning, before work begins on the project. Technical inspector shall make his/her cell phone number available to the installing contractor at the beginning of the project.
- C. Inspection Reports: Provide progress photos for application of each operation of roofing system. In addition to regular inspections, Manufacturer's Technical (non-sales) Representative shall be present for roof work starts at each section. Manufacturer's Technical Representative shall provide proof of no less than 10 years experience in the Roofing Industry.
- D. Roofing Inspector Qualifications: A full time technical representative of manufacturer (non-sales) experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification.
1. The Roofing Inspector shall be one of the following:

- a. An authorized full-time technical employee of the manufacturer with 10 years experience in commercial roofing.
    - b. If manufacturer does not employ full time technical personnel, inspection personnel shall be certified as a Registered Roof Observer by the Roof Consultants Institute and shall be experienced in the installation and maintenance of the specified roofing system and qualified to determine Installer's compliance with the requirements of this Project.
  - E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
    - 1. Manufacture shall verify watertightness of roof system by performing a nondestructive infrared or Tramex dielectric moisture survey.
    - 2. Notify Architect or Owner 48 hours in advance of date and time of inspection.
    - 3. Results will be made available to owner's representative in written form. Any defects or entrapped moisture found within the new roofing system installation will be removed and replaced at the installing contractor's expense.
  - F. Installing contractor to repair or remove and replace components of roofing system, at the sole expense of the installing contractor, where test results or inspections indicate that they do not comply with specified requirements.
  - G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.14 PROTECTING AND CLEANING
- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
  - B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
  - C. Sequence operations to avoid excessive or concentrated foot traffic and storage over roof areas while they cure.
  - D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075600

## SECTION 075713 – SPRAY POLYURETHANE FOAM ROOFING

### PART 1 GENERAL

1.00 This guide specification is for renewing previously installed polyurethane foam roofing system and recoating. Roofs with the following three coating coverage's are eligible. Any others must be approved individually by a representative of the manufacturer.

- A. SCM 3400 Series Silicone Roof Coating
- B. Other Silicone Roof Coatings
- C. Other Elastomeric Coatings and Approved Polyurethane Coatings

Regardless of the type of coating used, a representative from the manufacturer shall review each application and have the right to approve or reject any application. To be eligible for a Recoating Limited Warranty, the roof must meet the requirements in the "LIMITATIONS" section of this guide specification.

### 1.01 SECTION INCLUDES

- A. Preparation of Substrate.
- B. Sprayed in-place Polyurethane Foam Insulation.
- C. Silicone Roof Coating.
- D. Roofing Granules.

### 1.02 RELATED SECTIONS

- A. Section 079200 - Joint Sealants.

### 1.03 REFERENCES

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM D 93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.
- C. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -Tension.
- D. ASTM D 562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
- E. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
- F. ASTM D 471 - Standard Test Method for Rubber Property, Effect of Liquids
- G. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- H. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive

Bonds, adhesive bonding, peel strength, stripping strength.

- I. ASTM D 1353 - Standard Test Method for Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products.
- J. ASTM D 1549 - Test Method for Determination of Solar Reflectance
- K. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- L. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- M. ASTM D 1644 - Standard Test Methods for Nonvolatile Content of Varnishes.
- N. ASTM D 1653A - Standard Test Methods for Water Vapor Transmission of Organic Coating Films.
- O. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- P. ASTM D 2240 - Standard Test Method for Rubber Property, Durometer Hardness.
- Q. ASTM D 2370 - Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 and 100 degrees C.
- R. ASTM D 2697 - Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
- S. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- T. ASTM D 2856 - Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer.
- U. ASTM D 6083 - Standard Specification for Liquid Applied Acrylic Coating Used in Roofing.
- V. ASTM D 6694 - Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing.
- W. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials, flame spread, flame spread index, smoke developed, smoke developed.
- X. American Wood Preserve Bureau (AWPB) Standard LP-2
- Y. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.
- Z. SPFA (Spray Foam Alliance) A-Y Documents

#### 1.04 DESIGN / PERFORMANCE REQUIREMENTS

- A. Underwriters Laboratories, Inc. UL 790: Class A Fire Hazard Classification as applied to the deck types and inclines listed.



- B. Factory Mutual Approval for Bayseal Polyurethane Foam and Bayblock II, Bayblock HT, SCM 3400 coatings for use in Class 1 roof construction as described in the current edition of the FM Approval Guide. Windstorm rated 1-60 to 1-180 (depending on construction).
- C. Miami Dade NOA No. 03-0820.01 for Bayer MaterialScience LLC' single component Silicone coating system SCM 3400 Series membrane applied over foam roofs and complying with the Florida Building Code including High Velocity Hurricane Zone.

#### 1.05 SUBMITTALS

- A. Submit under provisions of General Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors.
  - 1. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and color.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing urethane foam products and systems of this section with minimum ten years documented experience.
- B. Installer Qualifications: A current Bayer MaterialScience LLC Qualified Applicator specializing in performing Work of this section with minimum three years documented experience.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging, clearly marked with the manufacturer's name, brand name, product identification, type of material, safety information, manufacture date, and lot numbers until ready for installation.
- B. Store silicone coating materials between 50 degrees F (18 degrees C) and 90 degrees F (29 degrees C) with careful handling to prevent damage to products. If conditions exceed these ranges, special consideration in storage must be taken. Do not store at high temperatures in direct sunlight.
- C. Protect all materials from exposure to moisture, freezing and other damage during transit, handling, storage, and installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### 1.08 PRE-INSTALLATION MEETINGS

- A. Convene pre-installation meeting prior to commencing work of this section.
- B. Attendance: Architect, Contractor, Manufacturer Representative, and roof system applicator.
- C. Agenda: Review installation sequence and scheduling.

#### 1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results and document with daily log. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply polyurethane foam or roof coating during periods of rain, snow, fog, and mist.
- C. Do not apply the polyurethane foam when substrate or ambient air temperatures are below 50 degrees F (10 degrees C) or above 120 degrees F (49 degrees C), or when wind velocities exceed 15 mph. Do not apply polyurethane foam when the substrate surface temperature is less than 5 degrees F (minus 15 degrees C) above the dew point.
- D. Do not apply silicone roof coatings when temperatures are below 40 degrees F (4.4 degrees C).
- E. Use windscreens during the application of the polyurethane foam and roof coating to prevent overspray onto surfaces not intended to receive foam and coating. Under no circumstances shall the polyurethane foam be applied when wind speeds exceed 15 miles per hour.

#### 1.10 WARRANTY

- A. Provide 10-year Full labor and Material Warranty upon completion, inspection and acceptance of the project. Warranty shall cover repair of leaks caused by deterioration of any component of the installed System, improper workmanship in the roof installation, and defects in the coating.
- B. WARRANTY LIMITATIONS
  - 1. Systems Warranty Administration will review all potential applications. Only those applications approved by manufacturer prior to the start of the application shall be candidates for a warranty.
  - 2. The repair history and data on all previous inspections shall be considered by manufacturer in determining if the roof is acceptable for renewing/recoating and obtaining a warranty.
    - a. Only approved substrates are eligible for a renewable warranty.
    - b. The renewed roof may be inspected by the Bayer MaterialScience LLC representative or an independent inspection firm, and any deviations from specifications will require repair.
    - c. An infrared moisture survey is required on all system renewables.
- C. PRE-JOB REQUIREMENTS AND APPROVAL
  - 1. The form "POTENTIAL CANDIDATE FOR WARRANTY" must be submitted to the Warranty Department prior to job start-up.

2. A Pre-job Inspection should be performed by the applicator, to determine all deviations, paying particular attention to areas of wet foam, if any.
3. MANUFACTURER REQUIRES THAT AN INFRARED MOISTURE SURVEY BE PERFORMED ON ALL ROOFS FOR RENEWABLE SYSTEM WARRANTY, WHICH IS AT THE OWNER OR APPLICATOR'S COST. THE COST MAY BE PAID BY THE OWNER OR APPLICATOR THROUGH A SET UPWARD ADJUSTMENT IN THE WARRANTY FEE.
4. IT IS THE APPLICATOR'S RESPONSIBILITY TO CORRECT ALL DEVIATIONS. ANY DEVIATIONS FOUND DURING THE INITIAL INSPECTION MUST BE CORRECTED PRIOR TO WARRANTY ISSUANCE, AT THE APPLICATOR'S COST.
5. BAYER MATERIALSCIENCE LLC RETAINS THE RIGHT TO PERFORM A POST-JOB MOISTURE SURVEY. IF WET FOAM IS FOUND, THE APPLICATOR IS RESPONSIBILITY TO REMOVE AND REPLACE, PRIOR TO WARRANTY ISSUANCE.
6. NO RENEWAL/RECOAT APPLICATIONS ARE TO BE STARTED BY THE QA WITHOUT BAYER MATERIALSCIENCE LLC ROOFING SYSTEMS' APPROVAL.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer (Basis of Design): Bayer MaterialScience LLC, 2400 Spring Stuebner Rd., Spring, TX 77389. ASD. Phone Toll Free: (800) 221-3626. Phone: (281) 350-9000. Fax: (281) 288-6450. Web Site: [www.spf.bayermaterialscience.com](http://www.spf.bayermaterialscience.com). E-mail: [joe.gizoni@bayer.com](mailto:joe.gizoni@bayer.com).
- B. Substitutions: As approved by Architect.

### 2.02 POLYURETHANE FOAM

- A. General: Spray, two-component monolithic polyurethane foam shall be Bayer MaterialScience LLC Bayseal, two- component, foam designed for use as a self- adhering, seamless, high insulating, spray applied rigid polyurethane foam roof system, as manufactured by Bayer MaterialScience LLC. Polyurethane foam may be required to replace a portion of the previously applied polyurethane foam, for example the existing foam is found to be wet. The Type of replacement foam shall be determined by the application and service conditions, in accordance with the recommendation of the polyurethane foam supplier. The installation to be applied should be a two component system made by Bayer MaterialScience LLC and combining an isocyanate component (Component A) and poyoy component (Component B). The cured sprayed-in-place polyurethane foam shall have the components as listed below in Bayseal 2.7.
- B. Bayseal 2.7 is designed for spray application and shall have the following minimum physical properties when cured:
  1. Minimum in-place Density: Minimum 2.7 lb/cf when tested in accordance with ASTM D 1622.
  2. Compressive strength: Minimum 45 psi when tested in accordance with ASTM D 1621.
  3. Closed cell content: Minimum 90 percent when tested in accordance with ASTM D

2856.

4. R-Value aged: 6.4 hr/sf/degrees F/Btu minimum at 1 inch thick when tested in accordance with ASTM C 518.
5. Dimensional Stability, 7 days, 158 degrees F, 100 percent R.H: Percent volume change, less than 1 percent when tested in accordance with ASTM D 2126.
6. Flame spread: Class II, less than 75 when tested in accordance with ASTM E 84.

## 2.03 SILICONE COATING

A. Silicone coating system shall be Bayer MaterialScience LLC' SCM 3400 Series single component silicone coating designed for use in as a weather seal coating over spray applied urethane foam roofing systems. Silicone coating shall have the following minimum properties:

1. Solids Content By Weight: 80 percent when tested in accordance with ASTM D 2697
2. Solids Content By Volume: 65 percent when tested in accordance with ASTM D 2697
3. Flash Point: Minimum 100 degrees F, Tagg closed cup.
4. Durometer Hardness, Shore A, 32 points when tested in accordance with ASTM D 2240.
5. Tensile Strength, 200 psi when tested in accordance with ASTM D 412.
6. Elongation, 400 percent when tested in accordance with ASTM D 570.
7. Water Absorption: 0.5 percent when tested in accordance with ASTM 526.
8. Weatherometer: Carbon-Arc, 4,000 hours. No observable degradation.

B. Silicone coating system shall be Bayer MaterialScience LLC' Baytec SiL 100 single component high solids, silicone coating designed to provide protection for architectural surfaces such as vertical walls, masonry, concrete, metal, single ply membranes and sprayed-in-place urethane foam systems. Silicone coating shall have the following minimum properties:

1. Tensile Strength, 225 psi when tested in accordance with ASTM D 412.
2. Elongation, 180 percent when tested in accordance with ASTM D 412.
3. Reflectivity, White: 84 percent when tested in accordance with ASTM C 1549.
4. Water Absorption: 0.5 percent when tested in accordance with ASTM D 471.
5. Permeably: Greater than 4 when tested in accordance with ASTM E 96 Procedure B.
6. Durometer Hardness, Shore A, 50 plus or minus 5 when tested in accordance with ASTM D 2240.
7. Solids Content By Weight: 95 percent when tested in accordance with ASTM D 1353.
8. Solids Content By Volume: 95 percent when tested in accordance with ASTM D

2697

9. Weatherometer: Carbon-Arc, 4,000 hours. No observable degradation.
10. Flash Point: Greater than 150 degrees F.
11. Color Topcoat:
  - a. White.

C. Baytec Sil 70

1. Tensile Strength, 486 psi when tested in accordance with ASTM D 412.
2. Elongation, 267 percent when tested in accordance with ASTM D 412.
3. Reflectivity, White: 84 percent when tested in accordance with ASTM C 1549.
4. Peel (wet) Strength greater than 2.0 lbs/inch when tested per WPSTM C 628
5. Durometer Hardness, Shore A, 50 plus or minus when tested per ASTM C 2240.
6. Solids Content By Weight: 80 percent when tested in accordance with ASTM D 1353.
7. Slides Content by Volume: 69 percent when tested in accordance with ASTM D 2697.
8. Viscosity: 9000 centipoise when tested per WPSTM C 560.
9. Color: White (also available in gray, tan, and dark gray).

D. Non-Slip Granules:

1. No. 11 screen size, ceramic-coated roofing granules as manufactured by the Industrial Products Division of 3M Company, color to best match topcoat or approved equal.
2. Low dust roofing granules as supplied by Specified Equipment Systems, Co., "SESCO GRANULES" or approved equal.

E. Walkways: Yellow Spaghetti, as manufactured by Greenstreak Plastic Products, Inc. or other approved by Bayer MaterialScience LLC.

F. Silicone Sealant or caulking: If Silicone Sealant or caulking is required for detail work or to seal the surface after samples are taken, one of the following GE Sealants & Adhesive sealants must be used: Silpruf Sealant SCS2008 or SCS2009; Construction 1200 Silicone Sealant SCS 1208 or SCS 1209.

2.04 PRIMER COATING

- A. Bayblock Prime EW: A two component, water based rust inhibitive primer for the preparation of ferrous and non-ferrous metal surfaces for the application of elastomeric coatings and spray polyurethane foam.
- B. Bayblock Prep, is a water based blend of surfactants formulated for the preparation of fully adhered EPDM roof surfaces.

- C. Bayblock Prime NS: A single component, water-based, general purpose primer to for the preparation of most non-metallic surfaces for the application of elastomeric coatings and spray polyurethane foam. Suitable for built-up roofing, wood, concrete, spray polyurethane foam, aged asphaltic and other substrates.

## 2.05 ACCESSORIES

- A. Wood nailers, sleepers or other wood blocking to be No. 2 Common Douglas fir or yellow pine, pressure treated in accordance with the current American Wood Preserve Bureau (AWPB) Standard LP-2.
- B. Fasteners:
  - 1. Fasteners for securing to wood substrates: Hot dipped galvanized steel nails, domestically produced; 3-1/2 inches (6.4 mm) long 16D spiral shank wire nail.
  - 2. Fastener for nailing sheet metal flanges to wood substrate: Hot dipped galvanized steel roofing nails, No. 11 or 12 gauge, barbed shank, minimum 3/8 inch (9.5 mm) diameter and head 1-1/2 inches (38 mm) long.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all surfaces to receive polyurethane foam insulation are clean, dry and free of dust, dirt, debris, oil, solvents and all materials that may adversely affect the adhesion of the polyurethane foam.
- C. Verify that all roof penetrations and flashings are properly installed and secured. Verify that metal roof opening covers designated to receive polyurethane foam insulation are permanently secured.
- D. Inspect roof for area of exposed foam or areas where thin coating has allowed foam to be burned beneath the coating.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Surface Preparation – SPF Roof
  - 1. Power wash existing SPF roof.
  - 2. Remove all coating that is loose or poorly adhered.
  - 3. Cut out all areas that are wet, punctures and soft spots in an industry acceptable manner.
  - 4. All severely burned SPF areas must be dug out and refoamed.
  - 5. All burnt foam areas, blisters and coatings shall be removed and repaired to insure adhesion of the new material.

6. The entire area to be coated will be clean, dry, and free of any contaminants, which would cause poor adhesion.
7. All burnt areas, cracks, holes, and other imperfections shall be cut and filled using a suitable caulk/sealant.
8. All areas that appear wet must be allowed to dry or removed and re-foamed.
9. All new foam must receive an additional 2 coats of coating.
10. Repair any pinholes.

### 3.03 SAFETY REQUIREMENTS

- A. Exercise care not to allow fumes from the polyurethane foam and coating materials to enter the building, using the following minimum precautions:
  1. Turn off all HVAC equipment and cover all intake vents and other potential sources of air entry into the building.
  2. Provide CO2 or other dry chemical fire extinguishers to be available at the jobsite.
  3. Provide adequate ventilation for all areas being worked.
- B. Proper safety precautions shall be followed throughout the entire roofing operation. Conform to safety precautions of Spray Polyurethane Foam Alliance of the American Plastics Council's Recommendations for the Safe Handling and Use of Sprayed Urethane Foam and Coating Materials.
- C. Provide fire extinguishers available on the roof and at all work sites at all times during roofing operations.

### 3.04 SPRAY POLYURETHANE FOAM APPLICATION

- A. Apply polyurethane foam in strict accordance with the manufacturer's specifications and application instructions.
- B. Apply in a minimum of 1/2 inch (12.5 mm) thick passes and 1-1/2 inch (38 mm) maximum thick passes. Total thickness of the polyurethane foam shall be a minimum of 1-1/2 inches (38 mm), except where tapering is required to facilitate drainage.
- C. Apply the full thickness of polyurethane foam in any area on the same day.
- D. Applied to ensure proper drainage, resulting in no ponding water. Ponding water is generally defined as "an area of 100 square feet or more, which holds in excess of 1/2 inch (12.5 mm) of water as measured 24 hours after rainfall.
- E. Terminate polyurethane foam neatly a minimum of 4 inches (102 mm) above the finished roof surface at roof penetrations. Foamed-in-place cants shall be applied to allow a smooth transition from the horizontal to vertical surface and shall be applied prior to the application of additional foam lifts to achieve specified thickness. Mask building surfaces to terminate the foam and coating in a neat, straight line.
- F. Finished polyurethane foam surface texture shall be "smooth to orange-peel", free of voids, pinholes and depressions. "Verge of popcorn" texture is acceptable if it can be thoroughly and completely coated. Popcorn and tree bark textures are not acceptable. Unacceptable foam textures must be removed and re-foamed prior to coating application.

### 3.05 SILICONE ROOF COATING APPLICATION

- A. Polyurethane foam surface shall be free of moisture, dust, dirt, debris and other contaminants that would impair the adhesion of the silicone coating.
- B. If more than 24 hours elapse between the polyurethane foam application and the start of the silicone coating application, thoroughly inspect the polyurethane foam surface for UV degradation and oxidation. Contact a Bayer MaterialScience LLC representative for guidance.
- C. Sprays apply coating in accordance with the manufacturer's application instructions and precautions in the technical datasheet. For new foam areas:
  - 1. Apply silicone basecoat on the same day as the polyurethane foam application, and after the polyurethane foam has been allowed to cure a minimum of one hour. If the basecoat is not applied within 24 hours of polyurethane foam, remove and repair all signs of oxidation, or other damages as required by manufacturer.
  - 2. Apply the basecoat in a uniform application to achieve a finished dry film thickness of approximately 12 to 15 mils.
  - 3. Basecoat shall not be subjected to foot traffic or otherwise disturbed until it is tack-free.
  - 4. Coating shall not be applied to the exposed leading edge of the foam at unfinished areas. Sandwiching of coating between foam passes is not permitted.
  - 5. After the basecoat has cured, inspect the coating for pinholes, cracks, thin areas or other deviations. All deviations observed shall be caulked with sealant and/or roller coated with additional basecoat prior to applying subsequent coats of silicone.
  - 6. Basecoat must be cured, clean and free of all moisture prior to application of intermediate coat and topcoat.
  - 7. Silicone coating should be applied in one coat of approximately ¼ gallon per square.
- D. Nominal thickness of additional the final dry film protective silicone coating system shall be an average 15 mils with a minimum of 25 mils including existing coating.
- E. Coating shall be applied a minimum of 2 inches beyond all the terminated edges of the polyurethane foam. Mask terminations to provide a straight edge, neat, finished appearance.
- F. Silicone coating shall be applied to the exterior of the vent coverings. Surfaces of the vent coverings shall be properly prepared as with any other substrate as outlined within this guide specification.
- G. Allow the topcoat to cure and inspect the finished coating surface for pinholes, cracks, thin areas, or other deviations. Repair any deviations observed with silicone sealant and/or additional silicone coating material.
- H. Granule Application (use this section if granule application is part of scope of work):
  - 1. Apply roofing granules immediately (within 3 minutes) after application of the finish coat of silicone coating. Immediate application is important to obtain maximum wet-out and embedment.



2. Apply the roofing granules, using suitable compressed air equipment, uniformly at a rate of approximately 40 lbs per 100 square feet of roof area.
  3. After the coating has fully cured, all loose granules shall be removed using a soft-bristled broom to prevent blocking gutters and clogging drains.
  4. Bare spots in the granulated surface shall be filled in by applying additional coating and granules in these areas.
- I. Walkways: (use this section if walkway application is part of scope of work) Yellow Spaghetti, factory-formed walkway pads may be used as walkways, around access scuttles, around rooftop equipment to provide a working surface, and wherever specified. Spot adhere the pads or rolls to the finished surface with generous buttons of silicone sealant.
  - J. Set splash blocks (if included as part of scope of work) on Yellow Spaghetti adhered with buttons of silicone sealant on completed foam and coated roof where indicated on Drawings.
  - K. Patch all holes 3 inches (76 mm) diameter or smaller, with silicone sealant, to same level as adjacent surfaces and apply coating.
  - L. Where larger holes occur, fill the opening with spray polyurethane foam to match the adjacent surfaces prior to applying the specified roof coating.
  - M. Set the strainer dome in dabs of silicone sealant.
  - N. Equipment Walkway Coatings: (if included as part of scope of work) Roofing granules or a reinforced polyester mesh shall be installed around all mechanical equipment as indicated on the Drawings. Install at least six feet around the perimeter as follows:
    1. Apply an additional coat of acrylic coating at the rate of 1-1/2 gallons per 100 square feet.
    2. Broadcast grade 11 roofing granules at a rate of 50 pounds per 100 square feet or lay down the reinforced polyester mesh while the coating is in a fluid condition.
    3. Seal granules or polyester mesh in by applying additional coating at the rate of 3/4 gallon per 100 square feet.

### 3.06 FIELD QUALITY CONTROL

- A. Roof system manufacturer shall provide independent inspection firm, to perform periodic follow-up inspections on the roof, through a standard warranty inspection program.
- B. Any areas that do not meet the minimum standards for application as specified herein shall be corrected by the applicator. Manufacturer's inspection or verification shall not constitute acceptance of responsibility for any improper application of material.

### 3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 075713



## SECTION 076200 – SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1.

#### 1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
  - 1. Manufactured reglets.
  - 2. Formed low-slope roof flashing and trim.
  - 3. Formed wall flashing and trim.
  - 4. Formed equipment support flashing.
- B. Related Sections include the following:
  - 1. Division 6 Section 061053 "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 7 Section 075216 "SBS Modified Bituminous Membrane Roofing" for installing sheet metal flashing and trim integrated with roofing membrane.
  - 3. Division 7 Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
  - 4. Division 7 Section 079200 "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
  - 1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.
- E. ANSI/SPRI ES-1: All manufactured roof edge shall meet or exceed ANSI/SPRI ES-1 design standards. Submit test reports for review.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
  - 1. Identify material, thickness, weight, and finish for each item and location in Project.
  - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
  - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
  - 2. Trim: 12 inches long. Include fasteners and other exposed accessories.
  - 3. Accessories: Full-size Sample.

#### 1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
  - 1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."
- B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

#### 1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 SHEET METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.
- B. Lead-Coated Copper Sheet: ASTM B 101, Temper H00 and H01, cold-rolled copper sheet, of weight indicated below, coated both sides with lead weighing not less than 12 lb/100 sq. ft. nor more than 15 lb/100 sq. ft. of copper sheet (total weight of lead applied equally to both sides).
- C. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
  1. Mill Finish: Standard one-side bright.

2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
  3. Anodized Finish: Apply the following coil-anodized finish:
    - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
    - b. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
1. Finish: No. 2D (dull, cold rolled).
- E. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.
- F. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting where indicated.
- G. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality with manufacturer's standard clear acrylic coating both sides.
- H. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
  3. Exposed Finishes: Apply the following coil coating:
    - a. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
- I. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

## 2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized paper, minimum 5 lb/100 sq. ft.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
  - 1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
  - 2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
  - 3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
  - 4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
  - 5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Solder for Lead-Coated Copper: ASTM B 32, Grade Sn60, 60 percent tin and 40 percent lead.
- E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- F. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
- G. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- H. Burning Rod for Lead: Same composition as lead sheet.
- I. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- J. Elastomeric Sealant: Generic type recommended by sheet metal manufacturers and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section 07920 "Joint Sealants".
- K. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- L. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- M. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- N. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
  - 1. Available Manufacturers:
    - a. Fry Reglet Corporation.
    - b. Hickman, W. P. Company.
    - c. Keystone Flashing Company, Inc.
  - 2. Material: Stainless steel, 0.0187 inch thick Copper, 16 oz./sq. ft. Lead-coated copper, 17.2 oz./sq. ft. Aluminum, 0.032 inch thick Galvanized steel, 0.0217 inch thick.
  - 3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  - 4. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
  - 5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

## 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.



## 2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing and Fascia Caps: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide joint cover plates.
1. Joint Style: Lap, 4 inches.
  2. Fabricate with scuppers as indicated on drawings of dimensions required with 4-inch- wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
  3. Fabricate scuppers from the following material:
    - a. Aluminum: 0.050 inch thick.
    - b. Galvanized Steel: 0.0276 inch thick.
    - c. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
    - d. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.
- B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.
1. Joint Style: Butt, with 12-inch- wide concealed backup plate and 6-inch- wide exposed cover plates.
  2. Fabricate copings from the following material:
    - a. Aluminum: 0.050 inch thick.
    - b. Galvanized Steel: 0.0396 inch thick.
    - c. Prepainted, Metallic-Coated Steel: 0.0396 inch thick.
- C. Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
1. Aluminum: 0.050 inch thick.
  2. Galvanized Steel: 0.0336 inch thick.
  3. Aluminum-Zinc Alloy-Coated Steel: 0.0336 inch thick.
  4. Prepainted, Metallic-Coated Steel: 0.0336 inch thick.
- D. Base Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch thick.
  2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
  3. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.
- E. Counterflashing: Fabricate from the following material:
1. Aluminum: 0.0320 inch thick.
  2. Galvanized Steel: 0.0217 inch thick.
  3. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.
  4. Prepainted, Metallic-Coated Steel: 0.0217 inch thick.
- F. Flashing Receivers: Fabricate from the following material:
1. Aluminum: 0.0320 inch thick.
  2. Galvanized Steel: 0.0217 inch thick.
  3. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.
  4. Prepainted, Metallic-Coated Steel: 0.0217 inch thick.
- G. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. hard tempered.
2. Galvanized Steel: 0.0276 inch thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

H. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft., hard tempered.
2. Copper: 13.2 oz./sq. ft.
3. Lead-Coated Copper: 12 oz./sq. ft.

## 2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
3. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.

## 2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
1. Coat side of uncoated aluminum and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
  2. Aluminum: Use aluminum or stainless-steel fasteners.
  3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
  4. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
  2. Pretinning is not required for lead-coated copper zinc-tin alloy-coated stainless steel and lead.
  3. Stainless-Steel Soldering: Pre-tin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
  4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
  5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
  6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
  7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

### 3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch centers.
  2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.
1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.

2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

### 3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets:
  1. Extend at least 1" into wall with hemmed inner edge to receive ribbed flashing and form a hook seam. Form hem on upper surface of metal so that completed will shed water.

### 3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

### 3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200



## SECTION 077100 – MANUFACTURED ROOF SPECIALTIES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Copings.
  - 2. Reglets.
  - 3. Counterflashing.
- B. Related Sections include the following:
  - 1. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, trim and fascia units, roof expansion-joint covers, and miscellaneous sheet metal accessories.
  - 2. Division 7 Section "Roof Expansion Assemblies" for roof expansion-joint covers.
  - 3. Division 7 Section "Roof Accessories" for manufactured curbs, roof hatches, gravity ventilators, penthouse ventilators, ridge vents, and smoke vents. Roof accessories installed integrally with roofing membrane are specified in roofing system Sections as roofing work.

#### 1.03 SUBMITTALS

- A. Product Data: For each type of product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Indicate layout, joining, profiles, accessories, anchorage, flashing connections, and relationship to supporting structure and to adjoining roof and wall construction.
- C. Samples for Initial Selection: Manufacturer's sample finishes showing the full range of colors and textures available for units with factory-applied color finishes.
- D. Samples for Verification: Of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work. Furnish straight Samples in lengths specified below or where corner pieces are required for Project; furnish corner Samples with each leg in lengths specified below:
  - 1. Copings: 8 inches long.
  - 2. Fascia: 8-inch long sections of each distinctly different fascia component, including scuppers and extenders (if any), exposed as finish work.
  - 3. Reglets and Counterflashing: 8 inches (200 mm) long.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured roof specialties capable of withstanding wind loads, structural movement, thermally induced movement, and exposure to weather without failing.
- B. Provide manufactured roofing specialties, incorporating roof edge treatment that complies with recommendations of FM Loss Prevention Data Sheet 1-49 for the following Wind Zone:
  - 1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.
- C. FMG Listing: Provide roofing specialties that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
- A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1.
- B. Flashings and Fastening: Comply with requirements of Division 07 Sections "Sheet Metal Flashing and Trim" and "Roof Specialties." Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
  - 1. FMG 1-49: Loss Prevention Data Sheet for Perimeter Flashings.
  - 2. NRCA Roofing and Waterproofing Manual (Fifth Edition) for construction details and recommendations.
  - 3. SMACNA Architectural Sheet Metal Manual (Fifth Edition) for construction details.
  - 4. The metal edge securement, except gutter, shall be installed as tested in accordance with the most current version of the ANSI\SPRI ES-1, American National Standard for Edge Systems Used with Low-Slope Roofing Systems.

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of manufactured roof specialty from one source and by a single manufacturer.

#### 1.06 PROJECT CONDITIONS

- A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best-possible weather resistance and protection of materials and finishes against damage.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



1. Formed-Aluminum Copings:
  - a. ABC Seamless, Inc.
  - b. Architectural Products Co.
  - c. ATAS International, Inc.
  - d. Cheney Flashing Company.
  - e. Hickman: W.P. Hickman Co.
  - f. Merchant and Evans, Inc.
  - g. Metal-Era, Inc.
  - h. MM Systems Corp.
  - i. Petersen Aluminum Corp.
  - j. Southern Aluminum Finishing Co.
2. Aluminum Reglets:
  - a. Fry Reglet Corporation.
  - b. Hickman: W.P. Hickman Co.
  - c. Keystone Flashing Company.
  - d. MM Systems Corp.

## 2.02 METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for use intended and finish indicated, and with not less than the strength and durability of alloy and temper designated below:
  1. Alloy 3003-H14, with a minimum thickness of 0.040 inch (1.0 mm), unless otherwise indicated, for aluminum sheet with mill finish.
  2. Alloy 5005-H14, with a minimum thickness of 0.050 inch (1.2 mm), for aluminum sheet with other than mill finish.
- B. Galvanized Steel Sheets: ASTM A 653, G90 (ASTM A 653M, Z275) coating designation; commercial quality; at least 0.034 inch (0.85 mm) thick, unless otherwise indicated.

## 2.03 COPINGS

- A. Provide copings in shapes and sizes indicated, with shop-fabricated corners. Include anchor plates formed from at least 0.028-inch- (0.7-mm-) thick, galvanized steel sheet; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.
- B. Provide exposed coping components fabricated from the following metal:
  1. Formed-aluminum sheet in thickness indicated, but not less than the following:
    - a. Thickness: 0.050 inch (1.3 mm).

## 2.04 REGLETS

- A. General: Provide reglets of type, material, and profile indicated, compatible with flashing. Form to securely interlock with counterflashing.
- B. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

- C. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
- D. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing's lower edge.
- E. Material: Fabricate reglets from the following metal in thickness indicated:
  - 1. Aluminum Sheet: 0.024 inch (0.6 mm) thick.

## 2.05 COUNTERFLASHING

- A. Provide counterflashing fabricated from the same metal as reglets and compatible with reglet system installed.

## 2.06 ACCESSORIES

- A. General: Provide manufacturer's standard accessories designed and manufactured to match and fit roof edge treatment system indicated.
- B. Exposed Fasteners: Stainless steel, nonmagnetic, of manufacturer's standard type and size for product and application indicated. Match finish of exposed heads with material being fastened.
- C. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- F. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- G. Foam-Rubber Seal: Manufacturer's standard foam.
- H. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand minimum 60-lbf/sq. ft. (2.9-kPa) wind-uplift force.

## 2.07 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

- C. Finish manufactured roof specialties after fabrication and assembly if products are not fabricated from prefinished metals.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.08 ALUMINUM FINISHES

- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
  - 1. Color: As selected by Architect from the full range of industry colors and color densities.

## 2.09 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. Remove pretreatment from galvanized steel sheet fabricated from coil stock by mechanical methods.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating of type compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified to comply with ASTM A 780.
- C. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply the air-dried primer specified below immediately after cleaning and pretreating.
  - 1. Shop Primer: Zinc-rich primers complying with performance requirements of SSPC-Paint 20.
- D. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.\

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine walls, roof edges, and parapets for suitable conditions for roof edge system installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Promptly remove protective film, if any, from exposed surfaces of finished metals. Strip with care to avoid damage to finish.
- B. Prepare concrete, concrete masonry block, cement plaster, and similar surfaces to receive roof edge system specified. Install blocking, cleats, water dams, and other anchoring and attachment accessories and devices required.

### 3.03 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Coordinate with installation of roof deck and other substrates to receive work of this Section and with vapor retarders, roofing insulation, roofing membrane, flashing, and wall construction, as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.
- B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended by aluminum producer.
- C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

### 3.04 CLEANING AND PROTECTING

- A. Clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.
- B. Protection: Provide protective measures as required to ensure work of this Section will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 077100

## SECTION 078100 – APPLIED FIREPROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes sprayed fire-resistive materials.
- B. Related Requirements:
  - 1. Section 078123 "Intumescent Fireproofing" for mastic and intumescent fire-resistive coatings.

#### 1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
  - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
  - 1. Extent of fireproofing for each construction and fire-resistance rating.
  - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
  - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 ; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
  - 2. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor are not allowed.
- D. Asbestos: Provide products containing no detectable asbestos.

## 2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Standard Durability SFRM, [Interior Locations, Concealed Conditions for Low Rise Buildings]: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix inorganic spray-applied fire resistive material containing mineral slag wool and Portland-cement are not permitted.
1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote MK-6
  2. Bond Strength: Minimum 200-lbf/sq. ft. (9.57-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
  3. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
  4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
  5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 10 or less.
    - b. Smoke-Developed Index: 10 or less.
  6. Compressive Strength: Minimum 10 lbf/sq. in. (68.9 kPa) according to ASTM E 761.
  7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
  8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
  9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
  10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
  11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in [no growth on specimens per ASTM G 21] [or] [rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273].
  12. Sound Absorption: [NRC] [or] [SAA] of [0.50 to 0.75] [0.60 to 0.70] [0.65 to 0.75] [not less than 0.60] <Insert range or single value> according to ASTM C 423 for Type A mounting according to ASTM E 795.
  13. Finish: [Spray-textured finish] [Rolled, spray-textured finish] <Insert requirement>.[ Apply separate, colored topcoat after finishing.]
- B. Intermediate Durability SFRM, [Interior Locations, Exposed to View Only or for Buildings Between 75 and 420 Feet Tall]: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix inorganic spray-applied fire resistive material containing mineral slag wool and Portland-cement are not permitted.
1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote MK-10/HB
  2. Bond Strength: Minimum 600-lbf/sq. ft. (28.4-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
  3. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
  4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
  5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 10 or less.

- b. Smoke-Developed Index: 10 or less.
- 6. Compressive Strength: Minimum 30 lbf/sq. in. (206 kPa) according to ASTM E 761.
  - 7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
  - 8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
  - 9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
  - 10. Air Erosion: Maximum weight loss of [0.025 g/sq. ft. (0.270 g/sq. m)] <Insert value> in 24 hours according to ASTM E 859.
  - 11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in [no growth on specimens per ASTM G 21] [or] [rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273].
  - 12. Sound Absorption: [NRC] [or] [SAA] of [0.50 to 0.75] [0.60 to 0.70] [0.65 to 0.75] [not less than 0.60] <Insert range or single value> according to ASTM C 423 for Type A mounting according to ASTM E 795.
  - 13. Finish: [Spray-textured finish] [Rolled, spray-textured finish] <Insert requirement>.[ Apply separate, colored topcoat after finishing.]
- C. Super High Rise Durability SFRM, [Interior Locations, for Buildings Over 420 Feet Tall]: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix inorganic spray-applied fire resistive material containing mineral slag wool and Portland-cement are not permitted.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote MK-1000/HB
  - 2. Bond Strength: Minimum 1000-lbf/sq. ft. (47.2-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
  - 3. Density: Not less than 18 pcf density as tested in accordance with ASTM E 605.
  - 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
  - 5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: [10] <Insert number> or less.
    - b. Smoke-Developed Index: [10] <Insert number> or less.
  - 6. Compressive Strength: Minimum 50 lbf/sq. in. (345 kPa) according to ASTM E 761.
  - 7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
  - 8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
  - 9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
  - 10. Air Erosion: Maximum weight loss of [0.025 g/sq. ft. (0.270 g/sq. m)] <Insert value> in 24 hours according to ASTM E 859.
  - 11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in [no growth on specimens per ASTM G 21] [or] [rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273].
  - 12. Sound Absorption: [NRC] [or] [SAA] of [0.50 to 0.75] [0.60 to 0.70] [0.65 to 0.75] [not less than 0.60] <Insert range or single value> according to ASTM C 423 for Type A mounting according to ASTM E 795.
  - 13. Finish: [Spray-textured finish] [Rolled, spray-textured finish] <Insert requirement>.[ Apply separate, colored topcoat after finishing.]
- D. Medium Durability SFRM, [Interior Locations, Exposed Conditions to Abrasion/Moisture]: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated



fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix inorganic spray-applied fire resistive material containing mineral slag wool and Portland-cement are not permitted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote Z-106/HY
2. Bond Strength: Minimum 2000-lbf/sq. ft. (94.5-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 22 pcf density as tested in accordance with ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 10 or less.
- b. Smoke-Developed Index: 10 or less.

6. Compressive Strength: Minimum 100 lbf/sq. in. (680 kPa) according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of [0.025 g/sq. ft. (0.270 g/sq. m)] <Insert value> in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in [no growth on specimens per ASTM G 21] [or] [rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273].
12. Sound Absorption: [NRC] [or] [SAA] of [0.50 to 0.75] [0.60 to 0.70] [0.65 to 0.75] [not less than 0.60] <Insert range or single value> according to ASTM C 423 for Type A mounting according to ASTM E 795.
13. Finish: [Spray-textured finish] [Rolled, spray-textured finish] [Skip-troweled finish] <Insert requirement>.[ Apply separate, colored topcoat after finishing.]

- E. High Durability SFRM, [Interior or Exterior Locations, Exposed Conditions Subject to Impact or Direct Moisture]: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote Z-146
2. Bond Strength: Minimum 10000-lbf/sq. ft. (478-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 40 pcf density as tested in accordance with ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 10 or less.
- b. Smoke-Developed Index: 10 or less.

6. Compressive Strength: Minimum 500 lbf/sq. in. (3450 kPa) according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.

10. Air Erosion: Maximum weight loss of [0.025 g/sq. ft. (0.270 g/sq. m)] <Insert value> in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in [no growth on specimens per ASTM G 21] [or] [rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273].
12. Sound Absorption: [NRC] [or] [SAA] of [0.50 to 0.75] [0.60 to 0.70] [0.65 to 0.75] [not less than 0.60] <Insert range or single value> according to ASTM C 423 for Type A mounting according to ASTM E 795.
13. Finish: [Spray-textured finish] [Rolled, spray-textured finish] [Skip-troweled finish] [Skip-trowel finish with corner beads] <Insert requirement>.[ Apply separate, colored topcoat after finishing.]

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
  1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
  - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck is complete before beginning fireproofing work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

### 3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
  - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
  - 2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- L. Cure fireproofing according to fireproofing manufacturer's written instructions.
- M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
  - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
  - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
  - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  1. Test and inspect as required by Chapter 17 of the applicable building code.
  2. Shop drawings showing the minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly must be obtained from the architect.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
  1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

### 3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100



## SECTION 078123 – INTUMESCENT FIREPROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes mastic and intumescent fire-resistive coatings (MIFRC).
- B. Related Requirements:
  - 1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Structural framing plans indicating the following:
  - 1. Extent of fireproofing for each construction and fire-resistance rating.
  - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
  - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.

- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.
  - 1. Flat Paints and Coatings: 50 g/L.



2. Nonflat Paints and Coatings: 150 g/L.
  3. Primers, Sealers, and Undercoaters: 200 g/L.
  4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  5. Fireproofing Exterior Coatings: 350 g/L.
- E. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Asbestos: Provide products containing no detectable asbestos.

## 2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. MIFRC: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
1. Application: Designated for interior general purpose and conditioned interior space purpose use by a qualified testing agency acceptable to authorities having jurisdiction.
  2. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
  3. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.
  4. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.
  5. Finish: As selected by Architect from manufacturer's standard finishes.
    - a. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

- E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
  - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

### 3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
  - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
  - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
  - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
  - 4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.11.
  - B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
  - C. Fireproofing will be considered defective if it does not pass tests and inspections.
    1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
    2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
  - D. Prepare test and inspection reports.
- 3.5 CLEANING, PROTECTING, AND REPAIRING
- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
  - B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
  - C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
  - D. Repair fireproofing damaged by other work before concealing it with other construction.
  - E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

## SECTION 078443 – FIRESTOPPING

### PART 1 - GENERAL

- 1.1 Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of the provision of all materials, labor and equipment and the like necessary and/or required for the complete execution of all firestopping and smoke seal work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

NOTE: Firestopping is defined as a material, or combination of materials, to restore the integrity of fire rated walls and floors by maintaining an effective barrier against the spread of flame, smoke and toxic gases and further defined in 1.4 below.

1. Provide firestopping and smoke seals as indicated on the drawings and/or required to maintain full and continuous smoke and fire barrier between zones including:
  - a. Through penetration firestops and smoke-stops for all fire-rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

NOTE: A preinstallation conference shall be scheduled by the Contractor with this Specialty Contractor and all other Specialty Contractors, Subcontractors and the like to establish procedures to maintain optimum working conditions and to coordinate the work of this Section with related and adjacent work.

1.3 RELATED WORK SPECIFIED ELSEWHERE – Entire Project Specification

NOTE: Proper execution of this work will maintain the hourly ratings of the walls and floors and ensure progress of work in other Sections as listed below.

1.4 QUALITY ASSURANCE

- A. Firestopping systems (materials and design):
1. Shall conform to both Flame (F)P and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of field conditions.
  2. The F rating must be a minimum of 1 hour but not less than the fire resistance rating of the assembly being penetrated.
  3. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s).
  4. The fire test shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.

5. For joints, must be tested to UL 2079 or E 1399 and E 1966 with movement capabilities equal to those of the anticipated conditions.
  6. Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRR) for submittal.
- B. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical and mechanical duct work).
  - C. Firestopping sealants must be flexible, allowing for normal pipe movement.
  - D. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
  - E. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
  - F. For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.
  - G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
  - H. Material used shall be in accordance with the manufacturer's written installation instructions.
  - I. Firestopping shall be performed by a Specialty Contractor trained or approved, in writing, by firestop material manufacturer. Said specialist shall be as defined in the Conditions. Equipment used shall be in accordance with firestop material manufacturer's written installation instructions.
  - J. Materials shall conform to all applicable governing codes.
  - K. All materials used in the work shall be certified "asbestos free" and shall be free from any and all solvents or components that require hazardous waste disposal or, that after curing, dissolve in water.
  - L. All materials shall comply with the interior finish flame spread and smoke developed requirements for the area in which they are installed./ Coordinate with governing codes.
  - M. DEFINITIONS
    1. FIRESTOPPING: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on the wall or floor.
    2. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "system".
    3. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.

4. THROUGH-PENETRATION: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
5. MEMBRANE-PENETRATION: Any penetration in a fire-rated wall that breaches only one side of the barrier.
6. CONSTRUCTION GAPS: Any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

#### 1.5 SUBMITTALS

NOTE: A "Certificate of Conformance", from the manufacturer listed in Part 2, is required with the "Submittal Package" to ensure that the material selected meets all of the criteria of this specification as set forth in Paragraph 1.4 of this Section.

- A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate project characteristics, typical uses, performance and limitation criteria, and test data. Submittal should be in compliance with Section 013300.
- B. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.
- C. Engineering Judgments: Submit manufacturer's drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the "Tested" UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.
- D. Submit manufacturer's installation procedures for each type of product.
- E. Approved Applicator: Submit document from manufacturer where in manufacturer recognizes the installer as a qualified or submit a list of past projects to demonstrate capability to perform intended work.
- F. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer's installation instructions and details.
- G. Mockups:
  1. Prepare job mockup of the material proposed for use in the project as directed by Architect. Approved mockups shall be left in place as part of the finished project and will constitute the standard for remaining work, including aesthetics.
- H. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.

#### 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials to be used in the work of this section to the project site in original sealed containers with manufacturer's brand and name, lot numbers, UL labeling, mixing and installation instructions clearly identified thereon.
- B. Store all materials in accordance with manufacturer's directions from the project site at the contractors expense if date is expired.

#### 1.7 REFERENCE STANDARDS

##### A. American Society for Testing and Materials (ASTM)

- 1. E 814 – Standard Method of Fire Tests of Through Penetration Fire Stops.
- 2. E 119 – Methods of Fire Tests of Building Construction and Materials.
- 3. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- 4. E 136 – Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F.
- 5. E 1399 – Cyclic Movement and Measuring Minimum and Maximum Joint Widths.
- 6. E 1966 – Test Method for Resistance of Building Joint.
- 7. E 2174 – Standard Practice for On-Site Inspection of Installed Fire Stops.
- 8. E 05.11.14 – Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA); ASTM permanent number assignment pending approval of Draft.

##### B. Underwriters Laboratories, Inc. (UL)

- 1. UL 1479 – Fire Tests of Through Penetration Fire Stops.
- 2. UL 263 – Fire Tests of Building Construction and Materials.
- 3. UL 723 – Surface Burning Characteristics of Building Materials.
- 4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
- 5. UL "Fire Resistance Directory", current year, including but not limited to the following:
  - a. For penetrations by uninsulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT) – UL System: CAJ1235, CAJ1404, WL1152.
  - b. For penetrations by insulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EAMT) – UL System: CAJ5222, CAJ5250, CAJ5251, WL5171.



- c. For penetrations by PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) – UL System: CAJU2401, CAJ3185, CAJ3199, CAJ3234, WL3118, WL3179, WL3199.
  - d. For penetrations by combustible plastic pipe (open piping systems) – UL System: CAJ2174, CAJ2339, CAJ2351, CAJ2432, WL2168, WL2170, WL2185, WL2259.
  - e. For penetrations by multiple combustible and/or non-combustible items – UL System: CAJ8101, CAJ8133, WL8007.
  - f. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways – UL System: CAJ1406, CAJ1502, CAJ4053, CAJ6027, WJ6004, WL1207, WL1343, WL4030, WL6018.
  - g. For penetrations by steel ducts – UL System: CAJ7075, CAJ7082, WJ7045, WL7046, WL7006, WL7046, WL7081, WL7082.
  - h. For fire-rated construction joints and other gaps – OPL System: CEJ296P, CEJ302P.
6. For openings between structurally separate sections of wall and floors. At the top of walls – UL System: HWD0107, HWD0110, HWD0257, HWD0267, HWD0299, HWD0327, HWD0266, HWD 0333, HWD0334.
- C. Factory Mutual (FM) Approval Guide, current year.
- 1. FM Approval Standard of Firestop Contractors – Class 4991.
- D. Building code of the jurisdiction of the Work.
- E. National Fire Protection Association
- 1. NFPA 101 – Life Safety Code.
  - 2. NFPA 70 – National Electrical Code.
  - 3. NFPA 221 – Fire Walls and Fire Barriers (preliminary to be released).
  - 4. NFPA 251 – Fire Tests of Building Construction and Materials
- F. FICA “Manual of Practice”.
- G. Certification of “DRI” employee(s).
- H. International Firestop Council (IFC):
- 1. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)

## 2. Ref. 2 Inspectors Field Pocket Guide

### 1.8 PROJECT CONDITIONS

- A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
- B. Coordinate work required with work of other trades; firestopping shall, where practical, precede gypsum board or other applied sheet finishing operations.
- C. Where firestopping is installed at locations which will remain exposed in the finished work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as required against damage from other construction operations.

### 1.9 SEQUENCING

- A. Schedule firestopping after installation of penetrants but prior to concealing the openings.

### 1.10 PROTECTION

- A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Firestopping materials and systems shall meet the requirements specified herein.
- B. Architect must approve in writing any alternates to the materials and systems specified herein.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e., insulated and plastic pipe, a suitable intumescent material must be used.

### 2.2 SPECIFIED STANDARD: For purposes of establishing standards of quality and levels of performance and not for the purposes of limiting competition, the basis of this specification is upon units as manufactured by one of the following and their respective model suitable for the intended application.

- A. Hilti, Inc.
- B. Specified Technologies, Inc.
- C. Grace / IPC Corp.

- D. Nelson Firestop Products
- E. Tremco, Inc.
- F. U.S. Gypsum Company
- G. Johns Manville

2.3 PRODUCTS SHALL GENERALLY INCLUDE:

- A. Cast-In-Sleeves (3M CID).
- B. Mortar seals.
- C. Fire stop design sealant compounds, caulk and foam systems.
- D. Putty and putty pads.
- E. Firestop kits including collars, plugs, etc.
- F. Seal bags.
- G. Tapes and blankets.
- H. Intumescent design wrap strips.
- I. Mineral type unfaced safing insulation with third party wrap, 3.5 pcf density, UL R-10905 label.

2.4 ACCESSORY ELEMENTS

- A. Forming, damming materials shall be mineral fiber board or other suitable material recommended by nominated system manufacturer.
- B. Primers, sealant and solvent cleaners shall be as recommended by the nominated system manufacturer.
- C. Metal Systems – 20 gauge phosphatized, electro-galvanized steel plate and/or galvanized steel clips.

2.5 Balance of materials shall be as specified elsewhere in this Section.

PART 3 – EXECUTION

3.1 INSPECTION AND ACCEPTANCE

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.
- B. Verify the environmental conditions are safe and suitable for installation of firestop products./

- C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

### 3.2 PREPARATION

- A. The surface shall be dry, clean, and free of all foreign matter. Do not apply firestopping to surfaces previously painted or treated with a sealer, curing compound, water repellent or other coatings unless tests have been performed to ensure compatibility of materials.
- B. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.
- C. Mask where necessary to protect adjoining surfaces.
- D. Remove excess material and stains on surfaces as required.

### 3.3 INSTALLATION – GENERAL SYSTEMS

- A. Install in strict accordance with manufacturer's printed instructions as well as UL guidelines and state and local fire codes.
- B. Ensure that anchoring devices, backup materials, clips, sleeves, supports and other materials used in the actual fire test are installed.
- C. Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.
- D. Tool or trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.
- E. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance ratings. Combustible damming materials must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the firestopping system.

### 3.4 PENETRATION SEALS

- A. Penetrations are defined as conduits, cables, wires, piping, ducts or other elements passing through one or both outer surfaces of fire rated walls, floors or partitions and shall be firestopped on both sides of penetration in accordance with requirements set forth in Paragraph 1.4 of this Section.
- B. Where sleeves are used, same shall be as specified in Part 2 herein; in event that sleeves are not used, core openings and caulk or wrap penetrating items with intumescent system the full length of penetration and seal on both sides with intumescent caulk. Residual openings within square or rectangular holes shall be filled with compounds applicable for substrate encountered and all penetrations sealed on both sides with caulk.

### 3.5 FIELD QUALITY CONTROL

- A. Contractor shall immediately notify the Architect if the firestopping systems herein specified cannot meet the requirements of the specification.
- B. Contractor shall examine firestops to ensure proper installation and full compliance with this specification.
- C. All areas of work must be accessible until inspection by the applicable Code authorities.
- D. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

### 3.6 IDENTIFICATION

- A. Identify firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning—Firestop System—Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Firestop system designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Firestop system manufacturer's name.
  - 6. Installer's name.

### 3.7 CLEANING

- A. When finished work will be visible, clean adjacent surfaces in accordance with manufacturer's printed instructions.
- B. If visible in the finished work, remove temporary dams after initial cure of firestops.
- C. Correct staining and discoloring on adjacent surfaces.
- D. Remove all debris and excess materials entirely from site and leave work in a neat and clean condition.

### 3.8 FIRESTOP SYSTEM SCHEDULE

- A. The following schedules shall be completed by the Contractor and reviewed prior to submission to the Architect. The untitled table included shall be completed with each of the following categories of penetrating items.
  - 1. Single uninsulated metallic piping and conduit.
  - 2. Multiple uninsulated metallic piping and conduit.

3. Uninsulated plastic piping and conduit.
4. Insulated metallic piping.
5. Electrical cable.
6. Bus duct.
7. Miscellaneous penetrations.

B. Complete the additional tables for the following using the format provided.

1. Blanks, voids, holes.
2. Engineering judgments.
3. Ductwork engineering judgments.

### 3.09 WASTE MANAGEMENT

- A. Separate and recycle materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
- B. Set aside and protect materials suitable for reuse and/or remanufacturing.
- C. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

#### **PENETRATING ITEM:**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Item Size/ Description	Sleeve	F Rating	T Rating	Annular Space	Firestop Thickness	Tested Assembly No.


**BLANKS, VOIDS, HOLES:**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Size/Description	F Rating	T Rating	Firestop Thickness	Tested Ass'y No.

**ENGINEERING JUDGMENTS (Submit Actual Installation Drawing and Letter of Certification)**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Item/Size Description	F Rating	T Rating	Annular Space	Firestop Thickness	Packing Thickness


**DUCTWORK ENGINEERING JUDGMENTS** (Submit Actual Installation Drawing and Letter of Certification)

Manufacturer/Product Name:

Color:

Accessories:

Wall/FI Constructi on	Si ze	Fire Damp er	F	T	Annul ar Spac e Rang e	Firestop Thickne ss	Packing Thickne ss

END SECTION 078443



## SPECIFICATION – 079000 PRE-COMPRESSED EXPANSION JOINTS

### PART 1 – GENERAL

#### 1.01 Work Included

- A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.
- B. Related Work
  - Division 4 - Masonry
  - Division 7 - Thermal & Moisture Protection
  - Division 7 - Sealants, Caulking and Waterproofing

#### 1.02 Submittals

- A. General – Submit the following according to Division 1 Specification Section.
- B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
- C. Sample of material is required at time of submittal.
- D. All products must be certified by independent laboratory test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals—equal to 200 mph winds (ASTM E330-02-procedure A).
- E. All products must be certified by independent laboratory test report to ASTM E90-09 and to meet or exceed an STC 52 in STC 56 wall and OITC 38 rating in an OITC 38 wall.
- F. All products must be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.
- G. All products shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within 24 hours at room temperature 68°F (20°C).
- H. Quality and Environmental control: Manufacturer shall be certified to both ISO-9001:2015 (quality management) and ISO-14001:2015 (environmental management) and shall provide written confirmation that formal Quality and Environmental management systems and processes have been adopted.

1.03 Product Delivery, Storage and Handling

- A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.

1.04 Basis of Design

- A. All joints shall be designed to meet the specified performance criteria of the SEISMIC COLORSEAL product as manufactured by: (USA & International) EMSEAL JOINT SYSTEMS, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365.  
(Canada) EMSEAL, LLC 120 Carrier Drive, Toronto, Ontario, Canada M9W 5R1 Toll Free: 800-526-8365. [www.emseal.com](http://www.emseal.com)
- B. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories as called for in section 1.02 Submittals. Submittal of alternates must be made three weeks prior to bid opening to allow proper evaluation time.

1.05 Quality Assurance

- A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertightness or life safety at expansion joints in any way.
- B. Warranty – Manufacturer's standard warranty shall apply.
- C. LEED Building Performance Requirements:
  - 1) The VOC of the silicone must not exceed 40 grams/liter
  - 2) All substitute products must be proved to be certified by independent test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals—equal to 200 mph winds (ASTM E330-02-procedure A).
  - 3) Products must be proved to have been certified by independent test report in accordance with ASTM C518-04 and demonstrate an R-Value per 1-inch (25mm) of depth of not less than 2.15 at as-installed nominal joint size compression.
  - 4) Products must be proved to have been certified by independent test report to ASTM E-90-09 and to meet or exceed a STC rating of 52 and OITC rating of 38.
  - 5) Product must be proved by independent test report to have air permeability not to exceed 0.02 L/(s.m<sup>2</sup>) at 75 Pascals as required by the Air Barrier Association of America (ABAA) and conform to ASTM E283-04.

## PART 2 – PRODUCT

### 2.01 General

- A. Provide watertight, energy-efficient exterior joints in vertical-plane walls (above-grade). Typical locations include, but are not limited to the following: applications in window perimeters, other façade penetrations such as doors, store fronts, vents, HVAC units, panel to panel joints, curtain walls, control joints, between dissimilar materials, high-movement and seismic structural expansion joints, acoustic partition barriers, and new-to-existing connections.
- B. Provide SEISMIC COLORSEAL as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for vertical expansion joint locations.
- C. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
- D. Material shall be capable of movements of +50%, -50% (100% total) of nominal material size
- E. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating. Silicone coating to be available in a range of not less than 26 standard colors for coordination with typical building materials.
- F. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.
- G. Manufacturer's Checklist must be completed by expansion joint subcontractor and returned to manufacturer at time of ordering material.

### 2.02 Fabrication

- A. SEISMIC COLORSEAL by EMSEAL JOINT SYTEMS LTD must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks) with a mounting adhesive on one face.
- B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

## PART 3 – EXECUTION

### 3.01 Installation

#### A. Preparation of the Work Area

1. The contractor shall provide a properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on

manufacturer's standard system drawings or as shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.

2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the SEISMIC COLORSEAL being installed plus at least 1/4-inch (6mm) for the application of corner beads. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
3. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

### 3.02 Clean and Protect

- A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION 079000

## SECTION 079200 – JOINT SEALERS

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. Section Includes:

1. The sealing of joints indicated on schedule at the end of this section.
2. The sealing of exterior joints, including:
  - a. Coping joints
  - b. Joints around perimeter of frames
3. The sealing of interior joints, including:
  - a. Wall joints
  - b. Joints around perimeter of frames
  - c. Joints between countertops and walls
4. The sealing of concealed joints in sound-retardant assemblies, including:
  - a. Around all electric outlet boxes, between top and bottom stud runners and structure, and where indicated
5. The sealing of joints in floors and pedestrian paving
6. The sealing of penetrations through exterior walls and roofs by pipes, ducts and conduit
7. The sealing of other joints indicated on drawings

##### B. Joints of a nature similar to that of joints indicated on the schedule shall be sealed with same sealer, whether indicated on drawings to be sealed or not.

##### C. Related Sections:

1. Firestopping/smokestopping sealers: Elsewhere in Division 7
2. Joint sealers in roofing work: Elsewhere in Division 7
3. Joint sealers in plumbing work: Division 22
3. Joint sealers in mechanical work: Division 23
4. Joint sealers in electrical work: Division 26

#### 1.02 REFERENCES

- A. AAMA 800-92 -- Voluntary Specifications and Test Methods for Sealants; American Architectural Manufacturers Association; 1992.
- B. ASTM C 719-93 -- Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 1993.
- C. ASTM C 834-95 -- Standard Specification for Latex Sealants; 1995.

- D. ASTM C 919-84(88) -- Standard Practice for Use of Sealants in Acoustical Applications; 1984 (Reapproved 1988).
- E. ASTM C 920-95 -- Standard Specification for Elastomeric Joint Sealants; 1995.
- F. ASTM C 1193-91 -- Standard Guide for Use of Joint Sealants; 1991.
- G. ASTM D 2628-91 -- Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991.
- H. FS A-A-272 -- Caulking Compounds; 1980.

#### 1.03 SUBMITTALS

- A. Product Data: Manufacturer's data on each joint sealer, with instructions for substrate preparation and installation.
- B. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors (Products exposed to view only.)
- C. Samples for Color Verification: Cured samples of each color of each product used, prepared to simulate actual joints minimum 6 inches long; use substrates similar appearance to actual substrates. (Products exposed to view only.)
- D. Substrate Test Report for Each Sealer.
- E. Certified Product Test Reports: Independent testing agency reports showing compliance with all specified requirements.
  - 1. Reports may be on tests conducted up to 24 months before submission, provided the products tested were aged specimens of the same formulation as that to be used.
- F. Field Installation Test Reports.
- G. Certificates: For each sealer, provide manufacturer's certificate stating that the product complies with the specifications and is appropriate for the use it is being put to.
- H. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.

#### 1.04 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Execution of at least 50 sealer installations of similar size and scope.
  - 2. Similar installations completed within 5 years before start of this project.
  - 3. Lead mechanic assigned from among those experienced on previous similar projects.
- B. Substrate Tests: Have samples of actual substrate materials tested by manufacturer(s) of sealer products.
  - 1. Test to determine what preparation procedures (if any are necessary to make sealers adhere properly under environmental conditions that may occur during installation.
  - 2. Test to determine compatibility with substrates backers, and secondary seals, if any.
  - 3. Use manufacturer's standard test methods.

4. Report the sealer manufacturer's recommendations for substrate preparation and sealer installation and identify specific primer(s) required.
  5. The requirement for testing for this project will be waived if test reports based on previous testing of the products and substrates to be used are acceptable to the architect.
- C. Field Installation Tests: Before installation, test the adhesion of all sealers to actual substrates.
1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
  2. Select test joints representative of joints to be sealed by the product to be tested.
  3. Perform tests for each type of sealer.
  4. Do tests in the presence of the architect.
  5. Report acceptable results only.
- D. Mock-ups: Before beginning installation, install sealers in joints in actual construction as directed by the architect, to show color, materials, and installation. Keep mock-ups intact as the standard for evaluating the completed work.
- E. Preinstallation Meeting: Have the installer, sealer manufacturers' representatives, and other affected installers meet to review sealer installation and protection procedures and sequencing with other work.
- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.
- 1.06 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
1. Air or substrate temperatures exceed the range recommended by sealer manufacturer or is below 40 degrees F (4.4 degrees C).
  2. Substrate is wet, damp, or covered with snow, ice, or frost.
- B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the architect and get sealer manufacturer's recommendations for alternative procedures.
- C. Coordination Data: Compression gasket manufacturer's requirements for joint dimensional tolerances; provide to installers of joints to be sealed with compression gaskets.
- 1.07 WARRANTY
- A. Submit written warranty signed by contractor and installer guaranteeing to correct failures in sealer work that occur within 5 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failure is defined as failure to remain weathertight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

## PART 2 - PRODUCTS

## 2.01 MATERIALS - GENERAL

- A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.
1. For each generic product, use only materials from one manufacturer.
  2. Provide only materials, which are compatible with each other and with joint substrates.
  3. Colors of exposed sealers: As selected by the architect from manufacturer's standard colors.
- B. Manufacturers: Products of the manufacturers listed, provided they comply with requirements of the contract documents will be among those considered acceptable.
1. Polysulfide sealants:
    - a. A. C. Horn, Inc.
    - b. W. R. Meadows, Inc.
    - c. Pecora Corporation
    - d. Products Research & Chemical Corporation
  2. Silicone sealants:
    - a. Bostik Inc.
    - b. Dow Corning Corporation
    - c. Pecora Corporation
    - d. Tremco, Inc.
    - e. GE Silicones
    - f. Rhone-Poulenc, Inc.
  3. Urethane sealants:
    - a. Bostik Inc.
    - b. Mameco International, Inc.
    - c. Pecora Corporation.
    - d. Products Research & Chemical Corporation.
    - e. Sika Corporation.
    - f. Sonneborn Building Products Division/ChemRex, Inc.
    - g. Tremco, Inc.
    - h. W. R. Meadows, Inc.
  4. Acrylic solvent-release sealants:
    - a. Pecora Corporation
    - b. Koch Protective Treatments, Inc.
    - c. Tremco, Inc.
  5. Butyl sealants:
    - a. Pecora Corporation
    - b. Koch Protective Treatments, Inc.
    - c. Tremco, Inc.
  6. Acrylic-latex emulsion sealant:
    - a. Bostik Inc.



- b. Pecora Corporation
- c. Sonneborn Building Products Division/ChemRex, Inc.

## 2.02 ELASTOMERIC SEALANTS

- A. Elastomeric Sealants - General: Chemically curing elastomeric sealants of types indicated, complying with ASTM C 920, including specific Type, Grade, Class, and Uses indicated, as well as all other requirements specified.
  - 1. Where movement capability exceeding that measured by ASTM C 920 is specified, sealant shall withstand the total movement indicated while remaining in compliance with the other requirements specified, when tested in accordance with ASTM C 719, with base joint width measured at the time of application.
  - 2. For M-type substrates: Comply with requirements for Use M.
  - 3. For G-type substrates: Comply with requirements for Use G.
  - 4. For A-type substrates: Comply with requirements for Use A.
  - 5. For O-type substrates: Comply with requirements Use M (minimum) and Use O for the particular substrate.
- B. Two-Part Pourable Polysulfide Sealant: Type M, Grade P, Class 12-1/2, Use T.
- C. Polysulfide Sealant for Water Immersion: Type M, Grade NS, Class 12-1/2, Use T, specifically recommended by the manufacturer for sealing joints immersed continuously in water.
- D. One-Part Non-sag Polysulfide Sealant: Type S, Grade NS, Class 12-1/2, Use NT.
- E. High Movement Silicone Sealant: One- or two-part non-acid-curing, Grade NS, Class 25, Use NT, plus movement capability of at least 50 percent in both extension and compression.
- F. Medium Movement Silicone Sealant: One- or two-part non-acid-curing, Grade NS, Class 25, Use NT, plus movement capability of more than 25 percent but less than 50 percent in both extension and compression.
- G. High Strength Silicone Sealant: One-part, acid- or non-acid-curing, Type S, Grade NS, Class 25, Use NT; with not over plus or minus 30 percent movement capability.
- H. Mildew-Resistant Silicone Sealant: One-part, Type S, Grade NS, Class 25, Use NT, formulated with fungicide, for interior use on nonporous substrates.
- I. Silicone Sealant for Use T: One-part, non-acid curing, Type S, Grade NS, Class 25, Use T, Use M, plus movement capability of 50 percent in both extension and compression.
- J. All-Purpose Urethane Sealant: Multipart, non-sag, Type M, Grade NS, Class 25, Uses NT, M, G and A.
- K. Multipart Pourable Urethane Sealant: Type M, Grade P, Class 25, Use T.
- L. Non-sag Urethane Sealant for Use T: Type S or M, Grade NS, Class 25, Use T.
- M. One-Part Pourable Urethane Sealant: Type S, Grade P, Class 25, Use T.
- N. Urethane Sealant for Water Immersion: One- or two-part urethane, Grade NS, Class 25, Use NT, specifically recommended by the manufacturer for sealing joints immersed continuously in water.

## 2.03 SOLVENT-RELEASE-CURING SEALANTS

- A. Acrylic Sealant: Non-sag, one-part, solvent-release-curing; complying with ASTM C 920, Type S Grade NS, Use NT, with the following exceptions:
  - 1. Weight loss: 15 percent, maximum.
  - 2. Movement capability: 12-1/2 percent in both extension and compression, minimum.
- B. Butyl Sealant: Non-sag, one part, solvent-release-curing; complying with FS A-A-272, Type III; non-staining; paintable.

## 2.04 LATEX SEALANTS

- A. Acrylic-Latex Emulsion Sealant: One-part, non-sag, mildew-resistant, paintable; complying with ASTM C 834.

## 2.05 NON-CURING SEALERS

- A. Non-curing Butyl Sealant: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant.
- B. Butyl Polyisobutylene Sealant: Non-curing, nondrying, solvent-release; complying with 809.2, as described in AAMA 800.

## 2.06 COMPRESSION SEALS

- A. Compression Gaskets: Neoprene (polychloroprene) hollow gasket; complying with ASTM D 2628; sizes and shapes as indicated.
  - 1. Accordion Type
  - 2. Manufacturers:
    - a. The D. S. Brown Company.
    - b. Watson Bowman Acme Corp.

## 2.07 SEALANT BACKERS

- A. Backers - General: Non-staining; recommended or approved by sealant manufacturer for specific use.
- B. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

## 2.08 MISCELLANEOUS MATERIALS

- A. Primers: Use primers determined to be required by substrate tests.
- B. Cleaners: As recommended by sealer manufacturer and not damaging to substrates.
- C. Masking Tape: Nonabsorbent, non-staining.
- D. Tooling Agents: Approved by sealant manufacturer; non-staining to sealant and substrate.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.
- B. For compression gaskets, joints should have straight, parallel sides within proper tolerances, free of spalls.
- C. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Cleaning: Just before starting sealer installation, clean out joints in accord with recommendations of sealer manufacturers and as follows:
  - 1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
  - 2. Dry out damp and wet substrates thoroughly.
  - 3. Clean M-type and O-type substrates by suitable mechanical or chemical methods.
  - 4. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
  - 5. Concrete: Remove laitance and form-release coatings.
  - 6. Clean A-type and G-type substrates by chemical or other methods, which will not damage the substrate.
  - 7. Use methods, which will not leave residues that will impair adhesion.
- B. Priming: Prime substrates as recommended by sealer manufacturer.
- C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces, which would be damaged by contact or by cleanup. Remove tape as soon as practical.
- D. Install fillers where needed to provide proper joint depth or support for sealant backers.

### 3.03 INSTALLATION

- A. Comply with sealer manufacturers' instructions and recommendations, except where more restrictive requirements are specified.
- B. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.
- C. Sealants in Acoustical Assemblies: Comply with recommendations of ASTM C 919.
- D. Backers:
  - 1. Install backers at depth required to result in shape and depth of installed sealant, which allows the most joint movement without failure.
    - a. Make backers continuous, without gaps, tears, or punctures.
    - b. Do not stretch or twist backers.
  - 2. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.

- E. Sealants: Use methods recommended by manufacturer completely fill the joint; make full contact with bond surfaces; tool non-sag sealants to smooth surface eliminating air pockets.
  - 1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.

- F. Compression Gaskets: Use methods recommended by manufacturer; use as few end joints as possible; apply adhesive just before installing gaskets; make adhesively sealed joints at ends, corners, and intersections; install with top face approximately 1/8 to 1/4 inch below adjoining surfaces.

#### 3.04 PROTECTION AND CLEANING

- A. Clean surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.
- B. Protect joint sealers from contamination and damage.
- C. Remove and replace damaged sealers.

#### 3.05 SCHEDULE OF JOINT SEALERS

- A. General: Unless otherwise indicated, joints around perimeter of frames, where indicated to be sealed, are to be sealed using sealer specified for the substrate adjacent to the frame.
- B. Exterior Joints for Which No Other Sealer Is Indicated:
  - 1. Use one of the following sealants:
    - a. High movement silicone sealant
    - b. Medium movement silicone sealant
  - 2. Backer: Backer rod
  - 3. Joint shape: Concave joint configuration
- C. Interior Joints for Which No Other Sealer Is Indicated:
  - 1. Use one of the following sealants:
    - a. Acrylic-emulsion latex sealant
  - 2. Backer: Backer rod
  - 3. Joint shape: Concave joint configuration
- D. Below-Grade Joints:
  - 1. Use one of the following sealants:
    - a. Polysulfide sealant for water immersion
    - b. Urethane sealant for water immersion
  - 2. Backer: Backer rod
  - 3. Joint shape: Concave joint configuration
- E. Exterior Joints Well Protected from Weather and Not Subject to Movement:

1. Use one of the following sealants:
    - a. Acrylic sealant
    - b. Butyl sealant
  2. Backer: Backer rod
- F. Interior Floor Joints and Pedestrian Paving Joints, Less than 1-1/2 Percent Slope:
1. Use one of the following sealants:
    - a. Compression gasket
    - b. Two-part pourable polysulfide sealant
    - c. Silicone sealant for Use T
    - d. Two-part pourable urethane sealant
    - e. Two-part nonsag urethane sealant for Use T
    - f. One-part pourable urethane sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- G. Joints around Pipes, Ducts, and Conduit Penetrating Exterior Walls and Roofs:
1. Use one of the following sealants:
    - a. Same as used for adjacent substrates
- H. Joints in Interior Wet Areas:
1. Use one of the following sealants:
    - a. Mildew-resistant silicone sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- I. Concealed Joints in Acoustical Assemblies:
1. Use one of the following sealants:
    - a. Acrylic-emulsion latex sealant
    - b. Non-curing butyl sealant
    - c. Butyl polyisobutylene sealant

END OF SECTION 079200



## SECTION 079513 – EXPANSION JOINT COVER ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. Conform to sections of Division 1 as applicable.

#### 1.2 RELATED WORK

- A. Section 033000 – Cast – in – place concrete
- B. Section 079000 – Pre-Compressed Expansion Joints
- C. Section 079200 – Joint Sealants

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product technical data showing relevant performance criteria.
- B. Submit manufacturer's installation instructions.
- C. Submit shop drawings showing profile dimensions, splicing details, joinery details with other systems, special end conditions, fasteners, adhesives and relationships to adjoining work prior to shipment of materials to the site.
- D. Samples of profiles, colors and materials for each joint cover assembly for approval before used on site.
- E. Submit manufacturers warranty letters as per general requirements of the contract.

#### 1.4 QUALITY ASSURANCE

- A. Obtain expansion joint cover assemblies from one source (from a single manufacturer) whenever possible to avoid any compatibility issues.
- B. In addition to requirements of project specifications, comply with manufacturer's instructions and recommendations for all phases of work, including preparation of substrate, applying materials, and protection of installed units.
- C. Obtain a letter from the manufacturer certifying that product selection, preparation and placement of the expansion joint system is in accordance with manufacturer's requirements.
- D. Defects or deficiencies include adhesive and cohesive failures, system's inability to accommodate specified movements, moisture penetration in case of watertight applications, inability to withstand loading and traffic requirements, cracking of nosing/filler materials due to aggregate loading, not conforming to specified geometries, and improper workmanship.
- E. Defects and deficiencies are to be corrected by the expansion joint installer at no cost to the owner during the period of manufacturer's warranty.

- F. Products shall be installed either by manufacturers licensed applicators, approved installers or after installation training from the manufacturer.
- G. Materials and work should conform to all applicable codes and requirements of local authorities having jurisdiction.
- H. Where indicated, install fire barriers, before the installation of expansion joints.
- I. Install fire assemblies if required from one source (from a single manufacturer) and not necessarily from the expansion joint manufacturer to avoid compatibility issues in areas requiring fire barriers only and no expansion joint assemblies.

#### 1.5 ENVIRONMENTAL CONDITIONS

- A. Do not install products at temperatures less or more than published in manufacturer's product data.
- B. Do not install products without prior approval in damp or wet substrates.
- C. Do not install products without prior approval that might come in contact with aggressive media during the construction process.

#### 1.6 REFERENCES

- A. Reserved.
- B. ASTM – D2240 – 97, Durometer hardness in rubbers.
- C. Reserved
- D. Reserved
- E. ASTM – D3574, Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams - Compression Force Deflection
- F. Reserved

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Exercise proper care in handling of all work so as not to harm the finished surface, and take proper precautions to protect the work from damage after it is in place.
- B. Store materials under cover in a dry and clean location off the ground.
- C. Store adhesives, epoxies and resins at room temperature.
- D. Remove materials that are damaged or otherwise not suitable for installation and replace with acceptable materials before handing over the completed work to the site authorities.
- E. Installed assemblies should be identical to submitted and reviewed shop drawings, samples and certificates.



## PART 2 - MATERIALS AND PRODUCTS

### 2.1 MATERIALS

- A. Aluminum and steel alloys and extrusions should be treated and finished to suit project requirements.
- B. Rubber inserts should be ADA compliant and capable of withstanding design temperatures, design loads and design movements. Rubber inserts should be heat weldable when necessary to create watertight transitions.
- C. Nosing materials should conform to required elastomeric properties maintaining 1:2 resins to aggregate ratio.
- D. Preformed sealants and rubber products required to accommodate movements and maintain memory should not experience compression set beyond desirable limits as mentioned in ASTM standards given in 1.6 - section references.
- E. Profile design and shape should be ADA compliant and capable of withstanding design loads and provide structural separation and movement without disturbing the integrity of adjacent substrates.
- F. Fasteners or adhesive materials should not contaminate the substrate, create undue stresses at joint edges or compromise the functionality of adjacent materials and substrates.
- G. Reserved

### 2.2 FABRICATION

- A. Fabricate expansion joint covers, square, true, straight and accurate to required joint sizes and profile dimensions.
- B. Fabricate lengths in continuous runs of at least 2.00LM for precompressed sealants, at least 3.00LM for metal parts and at least 20.00LM for rubber parts.
- C. Assemble systems in shops wherever practicable.
- D. Make available to the installer all necessary tools, mixing equipment and welding equipment to ensure proper installation.
- E. Fabricate and supply all necessary accessories to suit the application and to deliver required performance.
- F. Provide isolation coatings, rust inhibitive paints or dielectric separators where aluminum components will be in contact with concrete, masonry or dissimilar materials.
- G. Fabricate and make available all profiles for flat and corner installations.
- H. Reserved

### 2.3 PRODUCTS

- A. Expansion joint assemblies installed in interior spaces should be able to accommodate a total movement of 33% of the specified joint width. Assemblies should be able to accommodate movement sin three directions under specified loading.

B. Interior floors with retrofit conditions or surface mounted assemblies:

Basis of Design: EMSEAL Migua FN series.

Expansion joint assemblies to bridge XXmm wide joint gaps comprising of metallic anchorage units (rails) installed on both sides of the gap and a flexible rubber insert bridging the gap. The anchorage units are fastened on top of the finished floor. Profile should be capable of withstanding loads from occasional vehicular traffic.

### PART 3 - EXECUTION

A. SURFACE CONDITION

1. Joint surfaces to receive seal shall be sound, smooth, straight, parallel, clean, dry and free of all visible contaminants. Applications of non-visible coatings or contaminants to surfaces of joint interface area prior to installation of seal shall be controlled by the Architect/Engineer in consultation with the expansion joint manufacturer.

B. INSTALLATION

1. The following is a general summary of installation requirements. In all cases the manufacturer's standard written instructions or specific instructions of a manufacturer's technician are to be followed.
2. Set work plumb, square, level and free from distortion.
3. Use anchoring devices and fasteners for securing expansion joint cover assemblies to in-place construction. Provide chemical fasteners wherever possible and as recommended or supplied by expansion joint manufacturer.
4. System to be leveled into and embedded in 2-part hi-mod epoxy-gel setting-bed as supplied by expansion joint manufacturer in blockout mounted horizontal applications. Ensure that no rattling or movement occurs between the substrate and the profile.
5. System to be leveled into and fastened to the studs behind the wall finishes in blockout mounted vertical applications.
6. Perform all cutting, assembling and fitting required for installation of expansion joint covers.
7. If being installed in blockouts on each side of the joint-gap, the blockout depth shall equal the system leg height plus ¼-inch (6mm). The blockout width on each side of the joint-gap will vary with model being installed and with size of joint-gap (consult with manufacturer before casting or cutting blockouts).
8. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Securely attach in place with all required accessories. Locate anchors at recommended intervals, and not less than 3 inches from each end.
9. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum. Lengths of profiles with one-piece anchorage unit are connected with

the help of slide-in connecting pins. Lengths of profiles with two-piece anchorage units are connected by staggering the aluminum profiles.

10. The blockouts in case of recessed profiles are to be filled flush to the floor or top surface of the expansion joint with a low-modulus elastomeric concrete capable of handling expected loads. If installing into floor where special floor covering is specified, joint system must be installed higher than the sub-floor level by an amount which will allow the flooring material to be installed flush to the finished surface of the joint system.
11. Reserved

### 3.2 CLEANING AND PROTECTION

- A. Do not remove protective materials until finish work in adjacent areas is complete.
- B. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.
- C. Remove all waste materials from the site.
- D. Seal shall be cleaned of all foreign matter as recommended by the seal manufacturer.
- E. Leave work in a condition satisfactory to the Architect/Engineer.

END OF SECTION 079513



## SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Integrated Door Opening Assemblies".
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
7. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of anchorages, joints, field splices, and connections.
  6. Details of accessories.
  7. Details of moldings, removable stops, and glazing.
  8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
  1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted

temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke Control Door Assemblies: Comply with NFPA 105.

- a. Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

- 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

#### 1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### 1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
  - 1. CECO Door Products
  - 2. Curries Company
  - 3. Steelcraft

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

### 2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard polyurethane. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 3.2 or better.
  - 3. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
  - 4. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
  - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
  - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
  - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by



referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
  - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polyurethane Core - 747 Series.
2. Curries Company (CU) - Steel-Stiffened - 747 Series.

2.4 STAINABLE STEEL DOORS – WOOD GRAIN PATTERN

- A. Fabricated from steel that has an embossed wood grain pattern extending the full height and width of the door.
1. Tough, clear top coat with UV protectors
  2. Glass lights feature frame trim finished to match door
  3. .005" deep engraved grain pattern
  4. Single or double openings - handed
  5. Fire rated - from 20 minutes up to 3 hours (Refer to Door Schedule for rating)
  6. Temperature Rise Rated (250°F)
  7. Polystyrene core provides structural strength and resists impact
  8. Insulated, general purpose, rated Standard to Extra Heavy-Duty
  9. 1 3/4" (44.4mm) Door Thickness
  10. Steel gauge: 18 (1.1 mm), 16 (1.4 mm)
  11. Galvannealed steel face sheets
  12. Custom Match Color
    - a. Custom match physical sampled provided by architect.
- B. Manufactures Basis of Design
- a. Steelcraft Grain Tech
  - b. Curries Curristain Wood Grain Doors 727 Series
  - c. CECO: Madera Stainable Steel Doors
  - d. Architect approved equal

## 2.5 SPECIAL FUNCTION HOLLOW METAL DOORS

- A. Sound Resistant Doors: Subject to the same compliance standards and requirements as standard hollow metal doors, provide manufacturer's standard sound resistant acoustic core tested in accordance with ASTM E90, ASTM 413, and ASTM E1332 standards. Fabricate with minimum 16 gauge construction, 1-3/4" thickness, combined with standard flush frames designed for mid-range and high range sound attenuation from STC 39 through STC 52 applications. Furnish complete with perimeter sound seals, bottom seals, and threshold as required for specified STC rating.
  - 1. Provide sound resistant doors with minimum STC sound rating (32, 38, 41, 43, 46, 50, 52, 54) as indicated on the door schedule:
  - 2. Each unit to bear a physical label applied to door certifying the product construction and identifying the specific STC rating.
  - 3. Manufacturers Basis of Design:
    - a. CECO Door Products (C) - Sound-Tech Express Series.
    - b. Curries Company (CU) - 757 Quiet Noise Series.

## 2.6 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
  - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  - 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
  - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet, opening widths up to 48".
  - 3. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet, opening widths greater than 48".
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## 2.7 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.8 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal components.

## 2.9 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
  - 1. Blade Type: Vision proof inverted V or inverted Y.
  - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
  - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
  - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## 2.10 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

## 2.11 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.12 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
  - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
  - 3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
  - 4. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
  - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
  - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
  - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
  6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
  7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
  8. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
    - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
    - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
    - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
    - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
  9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  10. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
  11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## 2.13 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113





## SECTION 081416 – FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Solid core doors with wood veneer faces.
- 2. Factory finishing wood doors.
- 3. Factory fitting wood doors to frames and factory machining for hardware.
- 4. Louvers installed in flush wood doors.
- 5. Light frames and glazing installed in wood doors.
- 6. Factory installed glazing in wood doors.

- B. Related Sections:

- 1. Division 08 Section "Hollow Metal Doors and Frames".
- 2. Division 08 Section 088100 "Glass and Glazing".
- 3. Division 08 Section "Door Hardware".
- 4. Division 08 Section 088810 "Glass and Glazing".
- 5. Division 08 Section 088117 "Fire-Rated Glass".

- C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- 2. ANSI A208.1 – Wood Particleboard.
- 3. Forestry Stewardship Council (FSC) - Guidelines for environmentally certified wood doors.
- 4. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
- 5. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
- 6. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
- 7. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
- 8. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

#### 1.3 SUBMITTALS

Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.

- A. Shop Drawings shall include:

- 1. Indicate location, size, and hand of each door.
- 2. Indicate dimensions and locations of mortises and holes for hardware.

3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data.
7. Indicate doors to be factory finished and finish requirements.
8. Indicate fire protection ratings for fire rated doors.

B. Samples for Initial Selection: For factory finished doors.

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
  - a. Provide samples for each species of veneer and core material.
  - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

C. Warranty: Provide sample of manufacturer's warranty.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.
  1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3<sup>rd</sup> party certification agency's procedure, except for size.
  2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - 1) Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## 1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
  - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
  - 2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
    - b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

## 2.2 CORE CONSTRUCTION

### A. Structural Composite Lumber Core Doors:

1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.

### B. Particleboard Core Doors:

1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
3. Blocking: As indicated under article "Blocking".

### C. Fire Resistant Composite Core Doors:

1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
2. Blocking: As indicated under article "Blocking".
3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

## 2.3 BLOCKING

### A. Fire Rated Doors:

1. Provide blocking as indicated below:
  - a. HB1: 5 inch in doors indicated to have closers and overhead stops.
  - b. HB4: Two 5 inch x 14 inch lock blocking in doors indicated to have exit devices.
  - c. HB8: Two 5 inch x 14 inch corner blocking and two 5 inch x 14 inch lock blocking on doors to have vertical rod exit devices.

## 2.4 VENEERED DOORS FOR TRANSPARENT FINISH

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Masonite
2. GT Industries
3. Architect Approved Equal

### B. Interior Solid Core Doors:

1. Grade: Premium.
2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch thickness at moisture content of 12% or less.

- a. Plain Sliced Select White Oak, A grade faces (Architect to confirm).
- 3. Match between Veneer Leaves: Book match.
- 4. Assembly of Veneer Leaves on Door Faces:
  - a. Running Match.
- 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 6. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
- 7. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
- 8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
- 9. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

## 2.5 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
  - 1. Blade Type: Vision proof inverted V or inverted Y.
  - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish.

## 2.6 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
  - 1. Wood Species: Same species as door faces.
  - 2. Profile:
    - a. M1 Flush Bead.
    - b. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
  - 1. Manufacturers:
    - a. Air Louver (LV).
    - b. All Metal Stamping (AP).
    - c. Pemko (PE).
- C. Glazing: Comply with installation requirements in Division 08 Sections 088100, 088117, and 088813 and with the flush wood door manufacturer's written instructions.

1. Pre-Installed Glazing: Install glazing in doors as indicated. Pre-installed glass to include all of the required glazing material.

## 2.7 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
  1. Comply with requirements in NFPA 80 for fire rated doors.
  2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Openings: Cut and trim openings through doors in factory.
  1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
  3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

## 2.8 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
  1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylate Polyester finish performance requirements.
  2. Staining:
    - a. Custom stain to meet architect's requirements.
  3. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

### 3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416





## SECTION 081743 – Colonial Wood Grain FRP/ Aluminum Hybrid Door

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Colonial Wood Grain FRP/ Aluminum Hybrid Door installed in Thermally Broken Aluminum Framing.
- B. Aluminum Panel

#### 1.02 RELATED SECTIONS

- A. Section 08 71 00 – Door Hardware
- B. Section 08 81 00 – Glazing and Glass

#### 1.03 REFERENCES

- A. ASTM-B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM-B221 – Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM-C518 – Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
- D. ASTM-D256 – Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.
- E. ASTM-D570 – Standard Test Method for Water Absorption of Plastics.
- F. ASTM-D638 – Standard Test Method for Tensile Properties of Plastics.
- G. ASTM-D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- H. ASTM-D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- I. ASTM-D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- J. ASTM-D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- K. ASTM-D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- L. ASTM-D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- M. ASTM-D5116 – Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products.
- N. ASTM-D6670 – Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/ Products.
- O. ASTM-E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- P. ASTM-E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- Q. NFRC 100 – Procedure for Determining Fenestration Products U-Factors.
- R. NFRC 400 – Procedure for Determining Fenestration Products Air Leakage.
- S. TAS 201 – Impact Test Procedures.
- T. TAS 202 – Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure.
- U. TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

#### 1.04 SUBMITTALS

- A. Must comply with Section 01 33 00 – Submittal Procedures.
- B. Action Submittals/ Informational Submittals.
  - 1. Product Data.
    - a. Submit manufacturer's product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.

2. Shop Drawings.
  - a. Submit manufacturer's shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
3. Samples.
  - a. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.
  - b. Submit manufacturer's sample of standard colors for door face and frame.
4. Testing and Evaluation Reports.
  - a. Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements listed in Section 2.04.
5. Manufacturer Reports.
  - a. Manufacturer's Project References.
    1. Submit list of successfully completed projects including project name, location, name of architect, type, and quantity of doors manufactured.
- C. Closeout Submittals.
  1. Operation and Maintenance Manual.
    - a. Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.
  2. Warranty Documentation.
    - a. Submit manufacturer's standard warranty.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications.
  1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.
  2. Door and frame components must be fabricated by same manufacturer.
  3. Evidence of a documented complaint resolution quality management system.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery.
  1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.
  2. Labels clearly identifying opening, door mark, and manufacturer.
- B. Storage.
  1. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.
- C. Handling.
  1. Protect materials and finish from damage during handling and installation.

#### 1.07 WARRANTY

- A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Standard Period.
  1. Ten years starting on date of shipment.
- C. Limited lifetime
  1. Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.
- D. Finish
  1. Stained SL-18 and SL-19-1 face sheets: 5 years.
  2. Anodized, aluminum: 10 years.

## PART 2 PRODUCTS

### 2.01 FRP/ALUMINUM HYBRID DOORS

- A. Manufacturer.
  - 1. Special-Lite, Inc.
    - a. PO Box 6, Decatur, Michigan 49045.
    - b. Toll Free (800) 821-6531, Phone (269) 423-7068, Fax (800) 423-7610.
    - c. Web Site [www.special-lite.com](http://www.special-lite.com).
  - 2. Architect Pre-Approved Equal

### 2.02 DESCRIPTION

- A. Model.
  - 1. SL-18 Colonial Wood Grain / SL-19-1 Contemporary Wood Grain Aluminum Hybrid Door.
- B. Door Opening Size.
  - 1. Refer to door schedule
- C. Construction.
  - 1. Door Thickness.
    - a. 1-3/4".
  - 2. Stiles & Rails.
    - a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
    - b. Minimum 2-5/16" deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
    - c. Screw or snap in place applied caps are not acceptable.
    - d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
    - e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
    - f. Meeting stiles to include integral pocket to accept pile brush weather seal [or Adjustable astragal by Special-Lite].
  - 3. Corners.
    - a. Mitered.
    - b. Secured with 3/8" diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
    - c. 1-1/4" x 1-1/4" x 3/16" 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
    - d. Weld, glue, or other methods of corner joinery are not acceptable.
  - 4. Core.
    - a. Poured-in-place polyurethane foam.
    - b. Laid in foam cores are not acceptable.
    - c. Foam Plastic Insulated Doors: IBC 2603.4.
      - 1. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.
      - 2. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.
      - 3. IBC 2603.4.1.7 foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when the face is metal minimum 0.032" aluminum or 0.016" steel.
      - 4. Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.
  - 5. Face Sheet.
    - a. Exterior
      - 1. 0.120" thick, colonial wood grain, stained FRP sheet.

- b. Interior
    - 1. 0.120" thick, contemporary wood grain, stained FRP sheet
    - 2. Class A rated
  - c. Attachment of face sheet.
    - 1. Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
    - 2. Use of glue to bond face sheet to core or extrusions is not acceptable.
- 6. Cutouts.
  - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
- 7. Hardware.
  - a. Pre-machine doors in accordance with templates from specified hardware manufacturers.
  - b. Surface mounted closures will be reinforced for but not prepped or installed at factory.
  - c. Factory install door hardware.
- 8. Reinforcements.
  - a. Aluminum extrusions made from 6061 or 6063 aluminum alloys.
  - b. Sheet and plate to conform to ASTM-B209.
  - c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
  - d. Bars and tubes to meet ASTM-B221.
- D. Sustainability Characteristics.
  - 1. LEED Declaration.
    - a. Entrance Products contribute to point calculations for the following credits:
      - 1. MR Credit 4.1 Recycled Content 10% (post-consumer = ½ pre-consumer) 1 point.
      - 2. MR Credit 4.2 Recycled Content 20% (post-consumer = ½ pre-consumer) 1 point.
    - b. All aluminum extrusions are produced using prime-equivalent billet produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes. The USGBC classifies these extrusions as pre-consumer recycled material.
    - c. Manufacturing facility located within 500 miles of major components and materials, including aluminum extrusions.
    - d. The point of recovery and smelting of pre-consumer recycled material within 500 miles of the manufacturing facility.

## 2.03 FRAMING

### A. Framing

- 1. Thermally Broken Aluminum Framing.
  - a. Model.
    - 1. SL-600TB.
  - b. Materials.
    - 1. See 2.05.A.
  - c. Perimeter Frame Members.
    - 1. Storefront frame with thermally broken pocket filler.
    - 2. Factory fabricated.
    - 3. Open-back framing is not acceptable.
  - d. Thermal Strut.
    - 1. Pultruded fiberglass only, no other materials will be accepted.
  - e. Applied Door Stops.
    - 1. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
    - 2. Provide solid ½" aluminum bar behind door stop for closer shoe attachment.
    - 3. Pressure gasketing for weathering seal.
    - 4. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
    - 5. Minimum ½" aluminum bar reinforcement under doorstop for required hardware attachments, aluminum to meet ASTM-B221.
  - f. Caulking.
    - 1. Caulk joints before assembling frame members.

- g. Frame Member to Member Connections.
  - 1. Secure joints with fasteners.
  - 2. Provide hairline butt joint appearance.
  - 3. Shear block construction only, no screw spline allowed.
- h. Hardware
  - 1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
  - 2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
  - 3. Factory install door hardware.
- i. Anchors:
  - 1. Anchors appropriate for wall conditions to anchor framing to wall materials.
  - 2. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
  - 3. Secure head and sill members of transom, side lites, and similar conditions.

## 2.04 PERFORMANCE

### A. Face Sheet.

- 1. Standard Exterior 0.120" thick, colonial wood grain, painted FRP sheet.
  - a. Flexural Strength, ASTM-D790:  $16.9 \times 10^3$  psi.
  - b. Flexural Modulus, ASTM-D790:  $0.9 \times 10^6$  psi.
  - c. Tensile Strength, ASTM-D638:  $7.5 \times 10^3$  psi.
  - d. Tensile Modulus, ASTM-D638:  $1.1 \times 10^6$  psi.
  - e. Barcol Hardness, ASTM-D2583: 38.
  - f. Izod Impact, ASTM-D256: 2.6 ft-lb/in.
  - g. Gardner Impact Strength, ASTM-D5420: 70 in-lb.
  - h. Water Absorption, ASTM-D570: 0.63%/24hrs at 77°F.
  - i. Taber Abrasion Resistance, Taber Test: 0.022% Max Wt. Loss, cs-17 wheels, 500 g. Wt., 25 cycles.
- 2. Interior Class A 0.120" thick, contemporary wood grain, painted FRP sheet.
  - a. Surface Burning, ASTM-E84: Flame Spread  $\leq 25$ , Smoke Developed  $\leq 350$ .

### B. Door Core.

- 1. Density, ASTM-D1622:  $\leq 5.0$  pcf.
- 2. Compressive Properties, ASTM-D1621: Compressive Strength  $\geq 60$  psi, Compressive Modulus  $\geq 1948$  psi.
- 3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3" x 3" FRP Facers  $\geq 53$  psi, Tensile Adhesion, 1" x 1" Foam  $\geq 104$  psi.
- 4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 °F, 100% humidity, 14 days  $\leq 13\%$ .
- 5. Thermal Conductivity, ASTM-C518, Thermal Resistance  $\geq 0.10$  m<sup>2</sup>K/W.

### C. Door Panel.

- 1. Indoor Air Quality, ASTM-D5116, ASTM-D6607: GreenGuard, GreenGuard Gold.

### D. Door and Thermally Broken Aluminum Frame Assembly.

- 1. Thermal Transmittance, NFRC 100.
  - a. Opaque Swinging Door (< than 50% glass)
    - 1. U-Factor = 0.31 Btu/hr-ft<sup>2</sup>-°F.
  - b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
    - 1. U-Factor = 0.60 Btu/hr-ft<sup>2</sup>-°F.
- 2. Air Leakage, NFRC 400, ASTM-E283.
  - a. Opaque Swinging Door (< than 50% glass)
    - 1. 0.02 cfm/sqft @ 1.57 psf.
    - 2. 0.03 cfm/sqft @ 6.24 psf.
  - b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
    - 1. 0.38 cfm/sqft @ 1.57 psf.
    - 2. 0.75 cfm/sqft @ 6.24 psf.
- 3. Sound Transmission, ASTM-E90: STC = 28, OITC = 27.

## 2.05 MATERIALS

- A. Aluminum Members.
  - 1. Aluminum extrusions made 6061 or 6063 aluminum alloys.
  - 2. Sheet and plate to conform to ASTM-B209.
  - 3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
- B. Fiberglass.
  - 1. See 2.02.C.5.
- C. Fasteners.
  - 1. All exposed fasteners will have a finish to match material being fastened.
  - 2. 410 stainless steel or other non-corrosive metal.
  - 3. Must be compatible with items being fastened.

## 2.06 FABRICATION

- A. Factory Assembly.
  - 1. Door and frame components from the same manufacturer.
  - 2. Required size for door and frame units, shall be as indicated on the drawings.
  - 3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
  - 4. All cut edges to be free of burs.
  - 5. Welding of doors or frames is not acceptable.
  - 6. Maintain continuity of line and accurate relation of planes and angles.
  - 7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.
- B. Shop Fabrication
  - 1. All shop fabrication to be completed in accordance with manufactures process work instructions.
  - 2. Quality control to be performed before leaving each department.

## 2.07 FINISHES

- A. Door.
  - 1. Aluminum.
    - a. Anodizing.
      - 1. Class 1 Anodizing, minimum 0.7 mils thick.
        - a. Color as selected by architect by manufacturers full range
  - 2. Colonial woodgrain FRP Face Sheets.
    - a. Stained.
      - 1. Color as selected by architect by manufacturers full range
  - 3. Contemporary wood grain FRP Face Sheets (interior).
    - a. Stained.
      - 1. Color as selected by architect by manufacturers full range
- B. Frame
  - 1. Aluminum.
    - a. Anodizing.
      - 1. Class 1 Anodizing, minimum 0.7 mils thick.
        - a. Color as selected by architect by manufacturers full range

## 2.08 ACCESSORIES

- A. Vision Lites.
  - 1. Factory Glazing.
    - a. Model.
      - 1. FL Standard with MNT-3.
    - b. Glazing Thickness.
      - 1. 1".

- c. Rectangular Lites.
      - a. Size, as indicated on drawings.
    - 2. Rectangular Vision Lite Accessories.
      - a. Finish.
        - 1. Color.
- B. Hardware.
  - 1. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
  - 2. Factory install hardware.
  - 3. Hardware Schedule.
    - a. As follows with remaining outlined in Section 08 71 00 – Door Hardware
      - 1. Hinges.
        - a. SL-11HD.
      - 2. Concealed adjustable bottom brush.
        - a. SL-301.
          - 1. Not for use with CVR type hardware.
      - 3. Concealed adjustable meeting stile astragal.
        - a. Adjustable astragal by Special-Lite.
      - 4. Mullions.
        - a. Model.
          - 1. SL-60.
- C. Architectural Panels.
  - 1. FRP Panels.
    - a. SL-36.
      - 1. Size, as indicated on drawings.
      - 2. Thickness.
        - a. 1".
      - 3. Face Sheet.
        - a. Material.
          - 1. Standard exterior and interior face, 0.062" thick, architectural-quality 5005 alloys, smooth texture
        - b. Finish to match Framing
      - 4. Performance.
        - a. 1" Thick Panel.
          - 1. Polyurethane foam core.
          - 2. Impervious to water.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine areas to receive doors.
- B. Notify architect of conditions that would adversely affect installation or subsequent use.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.02 PREPARATION

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

### 3.03 ERECTION

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors plumb, level, square, true to line, and without warp or rack.
- C. Anchor frames securely in place.
- D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.
- E. Set thresholds in bed of mastic and back seal.
- F. Install exterior doors to be weathertight in closed position.

- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by architect.
- H. Remove and replace damaged components that cannot be successfully repaired as determined by architect.

3.04 FIELD QUALITY CONTROL

- A. Manufacture's Field Services.
  - 1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.05 ADJUSTING

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.06 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.07 PROTECTION

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 081743



## SECTION 083100 – FLOOR ACCESS DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Work Included: Provide factory-fabricated floor access doors.

#### 1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
- B. Installer: A minimum of 2 years experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

#### 1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Basis-of-Design Manufacturer: Floor Access Doors by The Bilco Company, P.O. Box 1203, New Haven, CT 06505, 1-203-934-6363, Fax: 1-203-933-8478, Web: [www.bilco.com](http://www.bilco.com).
- B. Or Architect approved equal

## 2.2 ACCESS DOOR – TYPE TER – ARCHITECTURAL FLOORING

- A. Furnish and install where indicated on plans vault access door TER, size as shown on plans. Length denotes hinge side. The floor access door shall be single leaf and pre-assembled from the manufacturer.
- B. Performance characteristics:
  - 1. Cover: Shall be reinforced to support a minimum live load of 150 psf (732kg/m<sup>2</sup>) with a maximum deflection of 1/150th of the span.
  - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  - 3. Operation of the cover shall not be affected by temperature.
- C. Cover shall have a 1" (25mm) fillable pan to receive concrete or a combination of concrete and specified flooring material, including type, thickness, and weight per ft<sup>2</sup>. All fill material to be furnished and installed by GC in the field.
- D. Frame: Shall be extruded aluminum with full anchor flange around the perimeter.
- E. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" (6mm) gusset support plate.
- F. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the and the latch release shall be protected by a flush, gasketed, removable screw plug.
- G. Hardware:
  - 1. Hinges: Shall be a continuous heavy duty Type 316 stainless steel hinge that is accessible only when the cover is in the open position.
  - 2. Cover shall be equipped with an aluminum hold open arm that automatically locks the cover in the open position.
  - 3. Cover shall be fitted with the required number and size of compression spring operators.
  - 4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
  - 5. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
- H. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

## 2.3 ACCESS DOOR – TYPE J-AL CHANNEL FRAME

- A. Furnish and install where indicated on plans vault access door Type J-AL, size as shown on drawing. Length denotes hinge sides. The floor access door shall be single leaf and pre-assembled from the manufacturer.
- B. Performance characteristics:
  - 1. Cover: Shall be reinforced to support a minimum live load of 300 psf (1464 kg/m<sup>2</sup>) with a maximum deflection of 1/150th of the span.
  - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  - 3. Operation of the cover shall not be affected by temperature.
  - 4. Entire door, including all hardware components, shall be highly corrosion resistant.
- C. Cover: Shall be 1/4" (6mm) aluminum diamond pattern.
- D. Frame: Channel frame shall be extruded aluminum with bend down anchor tabs around the perimeter.
- E. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to covers with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.
- F. Drain Coupling: Provide a 1-1/2" (38mm) drain coupling located in the right front corner of the channel frame [note: can be placed at a different location if specified].
- G. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the covers when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" (6mm) gusset support plate.
- H. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.
- I. Hardware:
  - 1. Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 1/4" (6mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the covers do not protrude into the channel frame.
  - 2. Cover shall be equipped with a hold open arm which automatically locks each cover in the open position.
  - 3. Cover shall be fitted with the required number and size of compression spring operators. Springs and spring tubes shall be Type 316 stainless steel.
  - 4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of one cover.

- 5. Hardware: Shall be Type 316 stainless steel throughout.
- J. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

## 2.4 ACCESS DOOR – TYPE J CHANNEL FRAME

- A. Furnish and install where indicated on plans vault access door Type J, size as shown on drawings. Length denotes hinge side. The floor access door shall be single leaf and pre-assembled from the manufacturer.
- B. Performance characteristics:
  - 1. Cover(s): Shall be reinforced to support a minimum live load of 300 psf (1464 kg/m<sup>2</sup>) with a maximum deflection of 1/150th of the span.
  - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  - 3. Operation of the cover shall not be affected by temperature.
- C. Cover: Shall be 1/4" (6mm) Type 316 Stainless Steel diamond plate pattern.
- D. Frame: Channel frame shall be 1/4" (6mm) steel with full anchor flange around the perimeter.
- E. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.
- F. Drain Coupling: Provide a 1-1/2" (38mm) drain coupling located in the right front corner of the channel frame (note: can be placed at a different location if specified).
- G. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" (6mm) gusset support plate.
- H. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.
- I. Hardware
  - 1. Hinges: Heavy forged brass hinges, each having a minimum 3/8" (10mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.
  - 2. Cover shall be equipped with a hold open arm which automatically locks the cover in the open position.
  - 3. Cover shall be fitted with the required number and size of compression spring operators.
  - 4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
  - 5. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].

- J. Finishes: Factory finish shall be red oxide primed steel.

## 2.5 FIRE RATED ACCESS DOOR (FR)

- A. Furnish and install where indicated on plans vault access door Type FR, size as shown on drawings. Length denotes hinge side. The vault access door shall be single leaf. The vault access door shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
  - 1. Cover: shall be reinforced to support a minimum live load of 150 psf (732 kg/m<sup>2</sup>) with a maximum deflection of 1/150th of the span.
  - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing. Operation of the cover shall not be affected by temperature.
  - 3. Door and frame assembly shall be tested in accordance with ASTM E119 and NFPA 251 and UL Listed as having a 2-hour fire rating when exposed to fire from the underside. In the closed position, the temperature on the unexposed surface of the door shall not exceed 325°F (162°C) above ambient for the duration of the 2-hour period. Manufacturer shall submit a test report certifying this performance.
  - 4. Door shall be equipped with a fusible link activated closing system that will automatically close and latch the door leaf in the event of fire when heat parts the UL Listed 165° (74°C) fusible link. [Fire rated door may be specified to omit the automatic closing system when not required by the local authority having jurisdiction].
- C. Cover: Shall have a 1" (25mm) fillable pan to receive concrete or a combination of concrete and [insert specified flooring material, including type, thickness, and weight. All fill material to be furnished (Note: Finish flooring material up to 1/2" (13mm) thick can be installed in the 1" (25mm) pan. The remaining depth must be filled with concrete to maintain the fire rating of the door assembly. If finish flooring is not desired, the pan must be filled with 1" (25mm) of concrete).
- D. Frame: Shall be extruded aluminum with full anchor flange around the perimeter.
- E. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" (6mm) gusset support plate.
- F. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the and the latch release shall be protected by a flush, gasketed, removable screw plug].
- G. Automatic closing system: Shall be a self-contained, pneumatic, fusible link activated, closing system that will automatically close and latch the door in the event of fire when heat parts the UL Listed 165° (74°C) fusible link. (Note: Fire rated door may be specified without the automatic closing system when not required by the local authority having jurisdiction).
- H. Hold-open system: Door shall be equipped with a pneumatic hold-open system to automatically hold the door in the open position (85°). A release button for the hold-open system shall be provided and shall reset itself when the cover is closed. (Note: When door is specified without automatic closing system, a mechanical aluminum hold-open arm is provided).
- I. Hardware:

1. Hinges: Shall be a continuous heavy duty Type 316 stainless steel hinge that is accessible only when the cover is in the open position.
  2. Cover shall be fitted with the required number and size of compression spring operators.
  3. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover and a cable release handle shall be provided to open the cover from the underside.
  4. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
- J. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

### PART 3 - EXECUTION

#### OR EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
1. Test units for proper function and adjust until proper operation is achieved.
  2. Repair finishes damaged during installation.
  3. Restore finishes so no evidence remains of corrective work.

### 3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION 083100

## SECTION 083113 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Flush access doors and frames for plumbing chase walls.
- B. Recessed drywall panel access doors for ceilings.

#### 1.02 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material in specified finish.
- D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

#### 1.03 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. UL 10B for vertical access doors and frames.

#### 1.04 COORDINATION

- A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.
- B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.01 STEEL MATERIALS

- A. Manufacturer's standard finish – No. 4 Stainless Steel Satin Finish.

#### 2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acudor Products, Inc.
  2. Babcock-Davis; A Cierra Products Co.
  3. Karp Associates, Inc.
  4. Larsen's Manufacturing Company.
  5. MIFAB, Inc.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Plumbing chase walls.
  2. Door: Minimum 14 gage thick sheet metal.
  3. Frame: Minimum 16 gage.
  4. Hinges: Continuous concealed hinge.
  5. Latch: Stainless steel screwdriver operated cam latch.
  6. Lock: Cylinder.
  7. Basis of Design: Acudor UF-5000
  8. Size: As shown on drawings (10"x10" Minimum).
- D. Recessed 5/8" Drywall panel access door
1. Locations: Ceiling access doors.
  2. Door: Minimum 22 gage with satin coat.
  3. Frame: Minimum 22 gage with satin coat.
  4. Hinges: Concealed hinge.
  5. Latch: Slotted screwdriver operated cam latch.
  6. Lock: Cylinder lock and key.
  7. Door Recess: 5/8" to accept 5/8" drywall
  8. Basis of Design: Acudor DW-5015 recessed access door.
  9. Size: As shown on drawings (12"x12" Minimum).
- E. Fire Rated Access Door – 1 Hour Rated
1. Locations: Ceiling access doors.
  2. Door: Steel-22 Gauge recessed fitted with 5/8" thick drywall suitable to accept skim coat finish on site.



3. Frame: Steel-22 Gauge press bent for strength and rigidity with pre-punched flanges for convenient mounting and accepting skim coat finish on site
  4. Hinges: Concealed hinge.
  5. Fire Rating (Ceilings): Meets 90 minutes Fire Resistance Rating in accordance with CAN ULC S101-14, ASTM E119-16 and NFPA 251
  6. Latch: Self-latching bolt, operated by flush key.
  7. Finish: Satin coat Steel
  8. Basis of Design: Acudor FWC-5015
  9. Size: As shown on drawings (12"x12" Minimum).
- F. Fire Rated Access Door – 2 Hour Rated
1. Locations: Drywall Walls and Ceilings
  2. Door: 20 gauge, filled with 2" thick fire rated insulation, Mounting Frame: 16 gauge, flange to be drywall taping bead flange
  3. Hinges: Concealed hinge.
  4. Fire Rating: (Walls): UL — 1-1/2 hour "B" label. ULC — 2 hour "B" label. Max size: 36 x 48. (Ceilings): Warnock Hersey International 3 hour rated in a non-combustible ceiling. 1 hour rated in a combustible ceiling. Max size: 24 x 36
  5. Latch: Universal self-latching bolt, operated by either a knurled knob or flush key. Doors can be prepared for mortise cylinder locks (Master Keying).
  6. Finish: Steel: 5 stage iron phosphate preparation with prime coat of white baked-on enamel. Stainless Steel: #4 satin polish
  7. Basis of Design: Acudor FW-5050-DW
  8. Size: As shown on drawings: (24"x24" Minimum).

## 2.03 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  1. For cylinder lock, furnish two keys per lock and key all locks alike.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### 3.02 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

## SECTION 085113 - ALUMINUM WINDOWS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes fixed and/or operable aluminum-framed windows for exterior locations.
- B. Related Sections include the following:
  - 1. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

#### 1.3 DEFINITIONS

- A. Performance class designations according to AAMA/WDMA/CSA 101/I.S.2/A440-08:
  - 1. AW: Architectural.
- B. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440-08:
  - 1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Minimum Test Size: Smallest size permitted for performance class (gateway test size) or as specified elsewhere in this section, whichever is more stringent. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class. Downsized test reports will not be considered acceptable.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
  - 1. Windows: 60" x 99".
- B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units of the minimum test size specified herein that pass AAMA/WDMA/CSA 101/I.S.2/A440-08, Uniform Load Structural and Uniform Load Deflection Tests:

1. Uniform Load Structural Test: 150 psf (positive and negative). Double Hung
2. Uniform Load Deflection Test: 100 psf (positive and negative). Double Hung
1. Uniform Load Structural Test: 225 psf (positive and negative). Fixed
2. Uniform Load Deflection Test: 150 psf (positive and negative). Fixed

## 1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
  1. Mullion details, including reinforcement and stiffeners.
  2. Joinery details.
  3. Weather-stripping details.
  4. Thermal-break details.
  5. Glazing details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
  1. Include similar samples of hardware and accessories involving color selection.
- D. Maintenance Data: For operable window sash, operating hardware and finishes to include in maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Product Qualifications: In order to confirm that the proposed product(s) conform to the material and performance requirements contained in these specifications, bidders shall include the following with their bid. Failure to comply with these requirements shall cause the bid to automatically be rejected.
  1. Bidder's Acknowledgement: Bidders shall include a letter in their bid stating the manufacturer and series (model) number of the product upon which its bid has been based. Changes in product (manufacturer or series) will not be permitted after the bid.
  2. Product Test Reports: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid comprehensive test reports not more than four years old prepared by a qualified testing agency for each window type being used on the project. Test reports based on the use of downsized test units will not be accepted.
  3. Product Details: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid full size product details showing all frame and sash details, dimensions, thermal break construction, wall thicknesses and joinery. Details must accurately reflect all glazing and hardware options specified herein.
- B. Product Requirements: For maximum performance, windows for this project must meet both the testing requirements as contained herein and the minimum material requirements specified.

Windows that carry the applicable AAMA rating but do not meet the material thicknesses, depths, etc. shall not be acceptable for use on this project.

- C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- F. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-08, "Standard/Specification for Windows, Doors, and Unit Skylights" for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
- H. Preinstallation Conference: If requested, conduct conference at project site to review methods and procedures related to aluminum windows including, but not limited to, the following:
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components.
  - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
  - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: For retrofit installations, verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
- b. Structural failures including excessive deflection, water leakage, or air infiltration.
- c. Faulty operation of movable sash and hardware.
- d. Deterioration of metals or other materials beyond that which is normal.
- e. Failure of insulating glass.

2. Warranty Period:

- a. Window: Five years from date of Substantial Completion.
- b. Balances: Class 6, Ten years from date of Substantial Completion.
- c. Insulated Glazing: 10 years from date of Substantial Completion.
- d. Painted Metal Finishes:
  - 1) Five years from date of Substantial Completion for AAMA 2603 Baked Enamel Finishes.
  - 2) Twenty years from date of Substantial Completion for AAMA 2605 Superior Performance Finishes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: The basis of design for these specifications is the Series 4700i Double Hung Side Load and 7700i Fixed/Transom as manufactured by Architectural Window Manufacturing Corporation, Rutherford, New Jersey.
- B. Equivalents: Subject to compliance with all material and performance requirements outlined in these specifications, "or equal" products by other manufacturers will be considered for use subject to review by the Architect. The Architect's decision regarding equivalency is final.

### 2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.080-inch (1.6-mm) thickness at any location for the main frame and sash members, except the frame sill which shall be a minimum of 0.125-inch.
- B. Frame/Sash Depth: 4 1/4" minimum frame depth; 1 3/4" minimum sash depth.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
  - 1. All fasteners must be concealed except where unavoidable for application of hardware.
  - 2. For application of hardware, where required, use non-magnetic stainless steel phillips machine screws.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
  - 1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- G. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

## 2.3 WINDOW

- A. Window Types: Double hung; Fixed and Transom
- B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440-08.
  - 1. Performance Class and Grade: AW-PG100 Double Hung.
  - 2. Performance Class and Grade: AW-PG150 Fixed and Transom.
- C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested with insulating glass for thermal performance according to AAMA 1503, showing a minimum CRF of 50.
- D. Thermal Transmittance: Provide aluminum windows with whole-window U-factor and SHGC maximums indicated when simulated in accordance with NFRC 100 and NFRC 200 at a model size of 48" x 72" and glazed with 1" Argon filled sputter coat Low-E (#2) insulated glass using a warm edge spacer.
  - 1. U-Factor: 0.45 Btu/sq. ft. x h x deg F and SHGC 0.28 or less for Double Hung.
  - 2. U-Factor: 0.38 Btu/sq. ft. x h x deg F and SHGC 0.34 or less for Fixed
- E. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440-08, Air Infiltration Test.
  - 1. Maximum Rate: 0.25 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
- F. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
  - 1. Test Pressure: Not more than 15 lbf/sq. ft.
- G. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.

- H. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- I. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-08 for operating window types indicated.

## 2.4 INSULATED GLAZING

- A. Construction: All windows (except those receiving insulated panels) shall be factory glazed with hermetically sealed 1" insulating glass units with a dual seal of polyisobutylene and silicone and a desiccant filled spacer. Insulated glass must be set into a continuous bed of two-part structural silicone sealant and held in place with removable extruded aluminum snap-in beads. Wrap around (marine) glazing which requires the removal and disassembling of the sash for re-glazing will not be acceptable. Units must be IGCC certified for a CBA rating level.
  - 1. Exterior Glazing:
    - a. Thickness: 1/4"
    - b. Tint: Clear
    - c. Type: Tempered Glass
    - d. Coating: Guardian SuperNeutral 68, Vitro Solarban 60, Viracon VE-2M Low-E (or equal) (#2 Surface)
  - 2. Interior Glazing:
    - a. Thickness: 1/4"
    - b. Tint: Clear; Obscure in Locker rooms and Lavatories
    - c. Type: Tempered Glass
  - 3. Interspace Content: Argon
  - 4. Spacer Type: Warm Edge

## 2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.
- B. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
- C. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches (1800 mm) above floor.
- D. Double-Hung Windows: Provide the following operating hardware:
  - 1. Counterbalancing Mechanism: Comply with AAMA 902.
    - a. Sash Balance: Class 6, concealed Ultralift Extreme spring type capable of lifting 80% of sash weight, of size and capacity to hold sash stationary at any open position.
  - 2. Removable Lift-out Sash: Design windows and provide with hardware to permit removal of sash from inside for cleaning. Units with tilt-in sash will not be acceptable.



3. Handle: Continuous, integral lift rail on bottom rail of lower sash and pull-down rail on top rail of upper sash.
4. Lower Sash Lock: Spring-loaded, snap-type white bronze lock on bottom rail of lower sash (two if window is greater than 48" wide).
5. Upper Sash Lock: Pole-operated snap type white bronze lock on top rail of upper sash.

## 2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window. Provide insect screens on all operable sash.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  1. Extruded-Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch (1.3-mm) wall thickness.
  2. Finish: Match aluminum window members.
- C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
  1. Wire-Fabric Finish: Charcoal gray

## 2.7 ACCESSORIES

- A. Rescue Labels: Windows designated on drawings as "Rescue" or "Egress" windows shall meet all applicable codes and shall include a conforming label.

## 2.8 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
  2. No thermal short circuits shall occur between the exterior and interior.
  3. The thermal barrier shall be INSULBAR® or equal and shall consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
  4. Poured and debridged urethane thermal barriers shall not be permitted.

- D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch- thick extruded aluminum. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
- J. Muntins: Where shown on drawings, muntins shall be 3/8" deep profiled extruded aluminum applied to the exterior of 1" deep insulating glass. Roll formed muntins shall not be acceptable. Exterior applied muntins, where applicable, must be pinned to an integral bevel on the frame or sash. Products using applied bevels will not be accepted.
- K.

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Exterior of Window:
  - 1. Superior-Performance Organic Finish: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.
    - a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat thermocured system consisting of specially formulated inhibitive primer [and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - b. Color: As selected by Architect from manufacturer's standard non-mica, non-exotic, non-metallic colors. (Note: Exterior color may be different from interior color.)
- D. Interior of Window:

1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
  - a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.
  - b. Color: As selected by Architect from manufacturer's standard non-mica, non-exotic, non-metallic colors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
  1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
  2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
  3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 FACTORY TESTING

- A. One window for each seventy-five manufactured shall be randomly selected by the Owner and Architect to be tested at the manufacturer's facility for air and water infiltration in order to confirm compliance of the project's windows with the performance requirements contained in

these specifications. Bidders are to include the cost of transportation, food, and lodging for four representatives of the Owner and/or Architect to witness these tests.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: If desired, Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
  - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
  - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A. Field test pressures and allowable limits shall be as factored by AAMA 502 from those minimums required to determine laboratory compliance with the applicable Performance Class and Grade pursuant to AAMA/WDMA/CSA 101/I.S.2/A440-08.
  - 2. Testing Extent: One window as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
  - 3. Test Reports: Shall be prepared according to AAMA 502.
- C. Remediate noncomplying windows and retest as specified above.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of remediated doors or additional work with specified requirements.

### 3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Manufacturer shall clean all glass and aluminum prior to shipment.
- C. Protection of newly installed windows and/or final cleaning of glass and aluminum to remove any accumulations that may have occurred during the construction period is to be the responsibility of the General Contractor or Owner.
- D. Comply with manufacturer's written recommendations for final cleaning and maintenance.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system.

END OF SECTION 085113

## SECTION 087100 – DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Mechanical (and electrified) door hardware for the following:
    - a. Swinging doors.
  - 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Exclusions: Hardware for the following is not provided under the scope of this section, unless specifically listed in the hardware sets:
  - 1. Windows
  - 2. Cabinets (casework), including locks in cabinets
  - 3. Signage
  - 4. Toilet accessories
  - 5. Overhead doors
- C. Related Sections:
  - 1. Division 01 Section "Alternates" for alternates affecting the work of this section.
  - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation under the work of this section.
  - 3. Division 09 Sections for touchup finishing or refinishing of existing openings modified by the work of this section.

#### 1.3 REFERENCES

- A. Applicable state and local building codes and standards.
- B. Fire/Life Safety
  - 1. NFPA - National Fire Protection Association
    - a. NFPA 70 – National Electric Code
    - b. NFPA 80 - Standard for Fire Doors and Fire Windows
    - c. NFPA 101 - Life Safety Code
    - d. NFPA 105 - Smoke and Draft Control Door Assemblies

2. State and/or City Fire Safety Code
- C. UL - Underwriters Laboratories
  1. UL 10B - Fire Test of Door Assemblies
  2. UL 10C - Positive Pressure Test of Fire Door Assemblies
  3. UL 1784 - Air Leakage Tests of Door Assemblies
  4. UL 305 - Panic Hardware
- D. Accessibility
  1. ADA - Americans with Disabilities Act.
  2. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- E. DHI - Door and Hardware Institute
  1. Sequence and Format for the Hardware Schedule
  2. Recommended Locations for Builders Hardware
- F. ANSI - American National Standards Institute
  1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

#### 1.4 SUBMITTALS

- A. General:
  1. Submit the following in accordance with Conditions of Contract and Division 01 requirements.
  2. Advise Architect within the submittal package of incompatibility or issues which may detrimentally affect the work of this section.
  3. Prior To Forwarding Submittal: Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
- B. Action Submittals:
  1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
  2. Riser and Wiring Diagrams: After final approval of the hardware schedule, submit details of electrified door hardware, indicating the following:
    - a. Wiring Diagrams: For power, signal, and control wiring and including the following:
      - 1) Details of interface of electrified door hardware and building safety and security systems.
      - 2) Schematic diagram of systems that interface with electrified door hardware.
      - 3) Point-to-point wiring.
      - 4) Risers.
  3. Samples for Verification: If requested by the Architect, submit production sample or sample installations as requested of each type of exposed hardware unit in the finish indicated, and tagged with a full description for coordination with the schedule.

- a. Samples will be returned to the supplier in like-new condition. Units that are acceptable to the Architect may, after final check of operations, be incorporated into the Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening. Include the following information:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet; list locking device and function for each opening.
  - c. Type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for the local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and/or access control components). Operational description should include how the door will operate on egress, ingress, and fire/smoke alarm connection.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
5. Key Schedule:
  - a. After a keying meeting between representatives of the Owner, Architect, hardware supplier—provide a keying schedule listing the levels of keying as well as an explanation of the key system's function, the key symbols used and the door numbers controlled.
  - b. Utilize ANSI A156.28 "Recommended Practices for Keying Systems" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
  - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of the hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for the installation of door hardware.
- C. Informational Submittals:
1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
  2. Product Certificates for electrified door hardware, signed by the manufacturer:
    - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
  3. Certificates of Compliance:
    - a. Upon request of Architect or Authority Having Jurisdiction certificates of compliance for fire-rated hardware and installation instructions shall be made available.
  4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
  5. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
1. Operations and Maintenance Data : Provide in accordance with Division 01 and include the following:
    - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Name, address, and phone number of local representative for each manufacturer.
    - d. Parts list for each product.
    - e. Copy of final approved hardware schedule, edited to reflect conditions as-installed.
    - f. Copy of final keying schedule.
    - g. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
    - h. Copy of warranties including appropriate reference numbers for manufacturers to identify the project.

## 1.5 QUALITY ASSURANCE

- A. Product Substitutions: For the purpose of performing the work of this section, comply with product requirements stated in Division 01 and as specified herein.
1. Where a specific manufacturer's product is named and accompanied by the words "No Substitute," including make or model number or other designation, provide the product exactly as specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
- B. Supplier Qualifications and Responsibilities: A recognized architectural hardware supplier that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides a certified Architectural Hardware Consultant (AHC) available to the Owner, Architect, and Contractor, at reasonable times during the course of the Work for consultation.



1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  4. Coordination Responsibility: Coordinate installation of the electronic security hardware with the Architect and electrical engineers and provide installation and technical data to the Architect and other related subcontractors.
    - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in the application of commercial grade hardware that has a record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who can meet the following qualification requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
  2. Can provide installation and technical data to the Architect and other related subcontractors.
  3. Can inspect and verify components are in working order upon completion of installation.
  4. Capable of producing wiring diagrams.
  5. Capable of coordinating installation of the electrified hardware with the Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from a single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
  2. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to the authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

- I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
  - 2. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high [and] 3/4 inch (19 mm) high for exterior sliding doors].
  - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
  - 1. Attendees: Owner, Contractor, Architect, Installer, Supplier's Architectural Hardware Consultant.
  - 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
    - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    - b. Preliminary key system schematic diagram.
    - c. Requirements for key control system.
    - d. Requirements for access control.
    - e. Address for delivery of keys.
- L. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Inspect and discuss preparatory work performed by other trades.
  - 3. Review required testing, inspecting, and certifying procedures.
- M. Coordination Conferences:
  - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold a meeting for the purpose of reviewing any questions or concerns related to the proper installation and adjustment of door hardware.
    - a. Attendees: doors hardware supplier, door hardware installer, Contractor.
    - b. After the meeting, provide letter of compliance to the Architect, indicating when the meeting was held and who was in attendance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  - 1. Each article of hardware shall be individually packaged in manufacturer's original packaging.
- C. Project Conditions:
  - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  - 2. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
  - 1. Promptly replace products damaged during shipping with exactly the same products.
  - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during the course of the Work.
  - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys (and permanent cores) to Owner by registered mail or overnight package service.

## 1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- F. Direct shipments not permitted, unless approved by the Contractor.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

- a. Closers:
  - 1) Mechanical: 10 years.
  - 2) Electrified: 2 years.
- b. Exit Devices:
  - 1) Mechanical: 3 years.
  - 2) Electrified: 1 year.
- c. Locksets:
  - 1) Mechanical: 3 years.
  - 2) Electrified: 1 year.
- d. Continuous Hinges: Lifetime warranty
- e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

## 1.9 MAINTENANCE

- A. Maintenance Tools:

1. Furnish One (1) complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The Awarding Authority has determined that certain products will be selected for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
- B. Approval of manufacturers other than those listed shall be in accordance with QUALITY ASSURANCE article, herein.

Item	Scheduled Manufacturer
Hinges	Ives (IVE)
Continuous	Ives (IVE)

Flush Bolts & Coordinators	Ives (IVE)
Locksets & Deadlocks	Schlage (SCH)
Cylinders	Schlage (SCH)
Door Closers	LCN (LCN)
Overhead Stops	Glynn Johnson (GLY)
Door Trim	Ives (IVE)
Stops & Holders	Ives (IVE)
Silencers	Ives (IVE)
Weather Seals	Zero (ZER)
Key Cabinets	Telkee (TEL)

- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where the hardware specified is not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having the same operation and quality as the type specified, subject to the Architect's approval.

## 2.2 EXISTING MATERIALS

- A. Where existing door hardware is indicated to be removed and reinstalled:
  1. Carefully remove door hardware and components.
  2. Clean, protect and store existing door hardware in accordance with storage and handling requirements specified herein.
  3. Reinstall in accordance with installation requirements for new door hardware.

## 2.3 MATERIALS

- A. Fasteners
  1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
  2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
  3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent that no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Review door specification and advise Architect if thru-bolts are required.
  4. Hardware shall be installed with the fasteners provided by the hardware manufacturer.

- B. Modification and Preparation of Existing Doors: Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  - 1. When possible, use materials which match materials of adjacent modified areas.
  - 2. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.4 HINGES

- A. Provide five-knuckle, ball bearing hinges of type, material, and height as outlined in the following guide for this specification:
  - 1. Manufacturers:
    - a. Scheduled Manufacturer: Ives.
- B. Requirements:
  - 1. 1-3/4 inch thick doors, up to and including 36 inches wide:
    - a. Exterior: standard weight, bronze/stainless steel, 4-1/2 inches high
    - b. Interior: standard weight, steel, 4-1/2 inches high
  - 2. 1-3/4 inch thick doors over 36 inches wide:
    - a. Exterior: heavy weight, bronze/stainless steel, 5 inches high
    - b. Interior: heavy weight, steel, 5 inches high
  - 3. 2 inches or thicker doors:
    - a. Exterior: heavy weight, bronze/stainless steel, 5 inches high
    - b. Interior: heavy weight, steel, 5 inches high
  - 4. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
  - 5. Where new hinges are specified for existing doors and/or existing frames, the new hinge size must be identical to hinge preparation present in the existing door and/or existing frame.
  - 6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
    - a. Steel Hinges: Steel pins
    - b. Non-Ferrous Hinges: Stainless steel pins
    - c. Out-Swinging Exterior Doors: Non-removable pins
    - d. Out-Swinging Interior Lockable Doors: Non-removable pins
    - e. Interior Non-lockable Doors: Non-rising pins
  - 7. The width of hinges shall be 4-1/2 inches at 1-3/4 inch thick doors, and 5 inches at 2 inches or thicker doors. Adjust hinge width as required for door, frame, and/or wall conditions to allow proper degree of opening.

8. Provide hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to the electrified locking component.
9. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
10. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches or less in height. Provide one additional bearing hinge for each 30 inches of additional door height.

## 2.5 CONTINUOUS HINGES

### A. Aluminum Geared

1. Manufacturers:
  - a. Scheduled Manufacturer: Ives.
2. Requirements:
  - a. Provide aluminum geared continuous hinges conforming to ANSI A156.25, Grade 2.
  - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with .25 inch diameter Teflon coated stainless steel hinge pin.
  - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
  - d. Hinges shall be capable of supporting door weights up to 450 pounds, and shall be successfully tested for 1,500,000 cycles.
  - e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
  - f. Provide aluminum geared continuous hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware.
  - g. Install hinges with fasteners supplied by manufacturer. Hole pattern shall be symmetrically patterned.

## 2.6 CYLINDRICAL LOCKS – GRADE 1

### A. Manufacturer:

1. Scheduled Manufacturer: Schlage ND Series

### B. Requirements:

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1. Cylinders: Refer to "KEYING" article, herein.
2. Provide locksets able to withstand 1500 inch pounds of torque applied to the locked outside lever without gaining access per ANSI A156.2 Abusive Locked Lever Torque Test and cycle tested to 3 million cycles per ANSI A156.2 Cycle Test.
3. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications. Levers feature internal lock components that prevent damage caused by excessive force from persons kicking, hitting or standing on the lever to gain access.

4. Provide solid steel rotational stops to control excessive rotation of the lever.
5. Lockset to be completely refunctionable. Lockset design shall allow function of lock to be changed into over twenty other common functions by swapping easily accessible parts.
6. Provide locks with a standard 2-3/4 inches backset, unless noted otherwise, with a 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with a separate anti-rotation throughbolts, and shall have no exposed screws. Levers shall operate independently, and shall have two external return spring cassettes mounted under roses to prevent lever sag.
8. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
9. Provide electrical options as scheduled.
10. Lever trim shall be solid cast levers without plastic inserts, and wrought roses on both sides. Locksets shall be thru-bolted to assure proper alignment.
  - a. Lever design shall be Schlage Rhodes.
  - b. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

## 2.7 EXIT DEVICES

### A. Manufacturers:

1. Scheduled Manufacturer: Von Duprin 98 Series.

### B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
3. Exit devices shall incorporate a fluid damper or other device that eliminates noise associated with exit device operation. Touchpad shall extend a minimum of one half of the door width, but not the full length of the exit device rail. End-cap will have two-point attachment to door. Touch-pad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes; for all other finishes, the touch-pad finish shall be of compatible finish to exit device. Only compression springs will be used in devices, latches, and outside trims or controls.
4. Exit devices to incorporate a deadlatching feature for security and/or for future addition of alarm kits and/or other electrical requirements.
5. Concealed vertical exit devices shall be a cable-actuated concealed vertical latch system available in two-point and less bottom latch (LBL) configurations. Vertical rods are not acceptable.
  - a. Cable shall include color-coded stainless steel with polytetrafluoroethylene (Teflon®) liner and stainless steel core wire. Latches and center slides are color coded to aid in installation. Conduit and core wire ends snap into latch and center slides without the use of tools. Latchbolts and blocking cams shall be manufactured from sintered metal low carbon copper- infiltrated steel, with a molybdenum disulfide coating for low friction and consistent performance.
  - b. Top latchbolt shall have a minimum 0.382 inch and greater than 90 degree engagement with strike to prevent door and frame separation under high static load. Bottom latchbolt, when used, shall have a minimum of 0.44 inch engagement with strike.
  - c. Product cycle life shall exceed 1,000,000 cycles.



- d. Latch release does not require separate trigger mechanism.
- e. Top and bottom latch must operate independently of each other. Top latch will fully engage top strike even when bottom latch is compromised.
- f. Cable and latching system shall have the ability to:
  - 1) Be assembled as a complete assembly and function prior to being installed in the door.
  - 2) Install into the door as a one-piece single assembly
  - 3) Be installed independently of device installation and function on door even prior to device and trim installation.
  - 4) Connect to the exit device at a single attachment point.
  - 5) Adjust bottom latch height from a single point, after the system is installed and connected to exit device, while the door is hanging
  - 6) Alter latch position up and down within two-inches without additional adjustment.
  - 7) Ability to remove the system while door is hanging.
  - 8) Configure latchbolt mounting: double or single tab mount for steel doors, and wood doors, face mount for aluminum doors, eliminating requirement of tabs.
  - 9) Provide adjustable exit device to latch center line adjustment. Ensures double tab mounting option for top latch, regardless of exit device centerline.
- 6. Provide exit devices with manufacturer's approved strikes.
- 7. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
- 8. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.
- 9. Non-fire-rated exit devices shall have cylinder [hex key] dogging.
- 10. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
- 11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
  - a. Lever style will match the lever style of the locksets.
  - b. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
- 12. Exit devices for fire rated openings shall be UL labeled fire exit hardware.
- 13. Field drill weep holes per manufacturer's recommendation for exit devices used in full exterior application, highly corrosive areas, and where noted in the hardware sets.
- 14. Provide electrical options as scheduled.

## 2.8 FINAL CYLINDERS AND KEYING

- A. Tie into existing Best key system.
- B. General contractor furnish core 0 bit and turn over to the district locksmith for keying. All cost of keying and installation of final core shall be included in the lump sum of the contract.
- C. Coordinate a meeting with the owner to determine the key system and keying requirements for the building. Locks to be small format interchangeable core by Best.
- D. Furnish temporary cores. Return all temporary cores to the hardware supplier after final cores have been installed.
- E. Final Cylinders to have the following;
  - 1. Core to have concealed key control stampings
  - 2. Final biting list to be delivered to the owner.
- F. Keys shall have the following;
  - 1. Material: Nickel silver; minimum thickness of .092-inch (2.3mm)
  - 2. Keys to be stamped with visual key control.
  - 3. Key bow to have stamped "DO NOT DUPLICATE".
  - 4. Quantity: Furnish in the following quantities.
    - a. Change (Day) Keys: 3 per cylinder/core.
    - b. Final Control Keys: 3.
    - c. Master Keys: 6.

## 2.9 DOOR CLOSERS

- A. Manufacturers:
  - 1. Scheduled Manufacturer: LCN 4010/4110 Series.
- B. Requirements:
  - 1. Provide door closers certified to ANSI/BHMA A156.4 Grade 1 requirements by a BHMA certified independent testing laboratory. Closers shall be ISO 9000 certified. Units shall be stamped with date of manufacture code.
  - 2. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder, and shall utilize full complement bearings at shaft. Cylinder body shall be 1-1/2 inch diameter, and double heat-treated pinion shall be 11/16 inch diameter.
  - 3. Provide hydraulic fluid requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
  - 4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force as required by accessibility codes and standards. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
  - 5. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
  - 6. Closers shall not incorporate Pressure Relief Valve (PRV) technology.

7. Closer cylinders, arms, adapter plates, and metal covers shall have a powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or shall have special rust inhibitor (SRI).
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
9. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

## 2.10 ELECTRO-MECHANICAL CLOSER/HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturer: LCN 4040SE/4310ME/4410ME.

### B. Requirements:

1. Provide single-point or multi-point hold-open electro-mechanical closer/holders as specified. Verify voltage with Electrical Contractor and provide a transformer if necessary.
2. Provide multi-point electro-mechanical closer/holders with swing free arms.
3. Provide hydraulic fluid of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
5. Provide drop plates, brackets, or adapters for arms as required for details.
6. Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
7. Closer/Holders shall not incorporate Pressure Relief Valve (PRV) technology.

## 2.11 PROTECTION PLATES

### A. Manufacturers:

1. Scheduled Manufacturer: Ives.

### B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch thick as scheduled. Furnish with machine or wood screws, finished to match plates. Sizes of plates shall be as follows:
  - a. Kick Plates – 8 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
  - b. Mop Plates – 8 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs

## 2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.

Provide door stops for all doors in accordance with the following requirements:

2. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
3. Where wall stops cannot be used, provide dome type floor stops of the proper height.
4. At any opening where a wall or floor stop cannot be used, a medium duty surface mounted overhead stop shall be used.

## 2.13 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero.

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items as closely as possible. Size of thresholds shall be as follows:
  - a. Saddle Thresholds – 1/2 inch high x jamb width x door width
  - b. Bumper Seal Thresholds – 1/2 inch high x 5 inches wide x door width
2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.14 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.

B. Requirements:

1. Provide "Push-in" type silencers for each hollow metal or wood frame. Provide three for each single frame and two for each pair frame. Omit where gasketing is specified or required by code.

## 2.15 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: LCN.

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with a minimum of 25 pounds of holding force. Projection of holder and armature must be coordinated with other hardware and wall conditions to ensure that door sits parallel to

wall when fully open. Where magnetic holders are used on fire-rated doors, they must be wired into the fire control panel for fail-safe operation.

## 2.16 DOOR POSITION SWITCHES

### A. Manufacturers:

1. Scheduled Manufacturer: Schlage Electronics.

### B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Switches shall be installed as recommended by manufacturers installation instructions and coordinated with other hardware being installed on the opening. Coordinate door and frame preparations with door and frame suppliers. If separate switches are being used with a magnetic locking device provide a minimum of 4 inches between the switch and the magnetic locking device.

## 2.17 FINISHES

- ### A. Finish of all hardware shall be as specified within the hardware sets.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- #### A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- #### B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with the existing door and frame preparation and existing conditions.
- #### C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- #### D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- #### A. Where on-site modification of doors and frames is required, prepare hardware locations in accordance with the following:
1. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
  2. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
  3. Where doors are in rated assemblies, comply with NFPA 80 for restrictions on on-site door hardware preparation.

4. Where on-site modification of existing doors and frames is required:
  - a. Remove existing hardware being replaced, tag, and store according to contract documents.
  - b. Field modify and prepare existing door and/or frame for new hardware being installed.
  - c. When modifications are exposed to view, use concealed fasteners, when possible.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- C. Do not install surface mounted items until finishes have been completed on the substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Operating parts shall move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- I. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  1. Replace construction cores with permanent cores as indicated in keying section.
  2. Coordinate with owner for direction of the installation of permanent.
- J. Wire (including low voltage): Coordinate with the following work, provided under the scope of Division 26, ELECTRICAL.
  1. Conduit, junction boxes and wire pulls.
  2. Connections to and from power supplies to electrified hardware.
  3. Connections to fire/smoke alarm system and smoke evacuation system.

4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
  5. Testing and labeling wires with the Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
1. Configuration: Provide [one power supply for each door opening][least number of power supplies required to adequately serve doors] with electrified door hardware.
- M. Thresholds: Set thresholds scheduled herein, in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present a tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three [six] <Insert number> months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.7 DEMONSTRATION

- A. Provide training for the Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.8 DOOR HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with requirements of this section and the below-listed scheduled sets.
- B. It is intended that the following schedule includes complete items of door hardware necessary to complete the work. If a discrepancy is found in the scheduled hardware sets, such as a missing item, improper hardware for a frame, door or fire codes, provisions of the above-specifications shall govern.
- C. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:



#### HARDWARE GROUP NO. 01

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	98-L-07	630	VON
1	EA	PANIC HARDWARE	98-L-DT-07	630	VON
1	EA	SFIC MORTISE CYL.	80-101 X L583-255 36-083 36-082-025	626	SCH
			@ MULLION		
1	EA	SFIC RIM HOUSING	80-129	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR SWEEP	8193AA	AA	ZER
1	EA	MULLION SEAL	8780NBK 7FT PSA	BK	ZER
1	EA	THRESHOLD	546A-223-36" (914MM)	A	ZER
2	EA	DOOR CONTACT	679-05	✓ WHT	SCE
			BY DR MATERIAL TO SUIT		

#### HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	98-L-07-WH	630	VON
1	EA	SFIC RIM HOUSING	80-129	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 SCUSH SRI	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	8193AA	AA	ZER
1	EA	THRESHOLD	546A-223-36" (914MM)	A	ZER
1	EA	DOOR CONTACT	679-05	✓ WHT	SCE
			BY DR MATERIAL TO SUIT		

### HARDWARE GROUP NO. 03

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-2SI-07	626	VON
1	EA	SFIC MORTISE CYL.	80-101 X L583-255 36-083 36-082-025 @ MULLION	626	SCH
2	EA	SFIC RIM HOUSING	80-129	626	SCH
6	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
6	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7830 AS REQ (12/24/120V AC/DC TRI-VOLT)	689	LCN
2	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

### HARDWARE GROUP NO. 04

Provide each DE door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F	626	VON
2	EA	FIRE/LIFE CLOSER	4040SE WMS 24V/120V AC/DC AS REQ	689	LCN
2	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	ASTRAGAL	BY DOOR MANUFACTURER		

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

#### HARDWARE GROUP NO. 05

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	WALL STOP	WS406/407CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 06

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4011 WMS	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### HARDWARE GROUP NO. 07

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### HARDWARE GROUP NO. 08

Provide each DE door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F	626	VON
2	EA	FIRE/LIFE CLOSER	4040SE WMS 24V/120V AC/DC AS REQ	689	LCN
2	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	ASTRAGAL	BY DOOR MANUFACTURER		

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN AND TIED INTO THE FIRE DETECTION SYSTEM TO RELEASE HOLDER ALLOWING THE DOORS TO CLOSE AND LATCH WHEN UNDER ALARM.

#### HARDWARE GROUP NO. 09

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
2	EA	ASTRAGAL	BY DOOR MANUFACTURER		

#### HARDWARE GROUP NO. 10

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### HARDWARE GROUP NO. 11

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBR-07-499F	626	VON
2	EA	FIRE/LIFE CLOSER	4040SE WMS 24V/120V AC/DC AS REQ	✎ 689	LCN
2	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
2	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

#### HARDWARE GROUP NO. 12

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7830 AS REQ (12/24/120V AC/DC TRI-VOLT)	✎ 689	LCN
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

### HARDWARE GROUP NO. 13

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	SET	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB2F	689	IVE
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7830 AS REQ (12/24/120V AC/DC TRI-VOLT)	✓ 689	LCN
1	EA	GASKETING	488FSBK PSA	BK	ZER
2	EA	ASTRAGAL	BY DOOR MANUFACTURER		

### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

### HARDWARE GROUP NO. 14

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4011 WMS	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 15

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4011 WMS	689	LCN
1	EA	MOUNTING PLATE	4010-18	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### HARDWARE GROUP NO. 16

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	OH STOP	100S @ INACTIVE	630	GLY
1	EA	SURFACE CLOSER	4111 SCUSH @ ACTIVE	689	LCN
2	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 17

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBR-07-499F	626	VON
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7830 AS REQ (12/24/120V AC/DC TRI-VOLT)	✎ 689	LCN
2	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

#### HARDWARE GROUP NO. 18

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-2SI-07	626	VON
2	EA	SFIC RIM HOUSING	80-129	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### HARDWARE GROUP NO. 19

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4011 WMS	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 20

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	SILENCER	SR64	GRY	IVE



#### HARDWARE GROUP NO. 21

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4011 WMS	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 22

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80BD ATH	626	SCH
1	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
1	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 23

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	ND75BD ATH XN12-035	626	SCH
2	EA	SFIC FINAL CORE	BEST TO SUIT	630	BES
2	EA	SFIC CONSTRUCTION CORE	BEST TO SUIT	630	BES
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4011 ST-1544 WMS	689	LCN
1	EA	MOUNTING PLATE	4010-18	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 24

Provide each PR door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBR-07-499F	626	VON
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7830 AS REQ (12/24/120V AC/DC TRI-VOLT)	✎ 689	LCN
2	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER

#### OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY HELD OPEN BY MAGNETIC HOLDER TIED TO THE FIRE DETECTION SYSTEM.
2. WHEN FIRE DETECTION SYSTEM IS UNDER ALARM MAGNETIC HOLDERS WILL RELEASE ALLOWING DOORS TO CLOSE AND LATCH.

End of Section 087100

## SECTION 088100 – GLASS AND GLAZING

### PART 1 - GENERAL

#### 1.1 GENERAL PROVISIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

#### 1.2 SUMMARY

- A. This Section includes glass and glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Interior and exterior hollow metal doors and fixed frames.
  - 2. Interior and exterior Aluminum doors and frames.
  - 3. Interior and exterior Aluminum store front windows and curtain wall.
  - 4. Interior wood doors.

#### 1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
  - 1. Division 8 Section "Hollow Metal Doors and Frames": for steel doors and fixed hollow metal framed openings receiving glass and glazing.
  - 2. Division 8 Section "Flush Wood Doors": for wood doors vision lites receiving glass and glazing.
  - 3. Division 8 Section "Aluminum Doors and Storefronts": for steel doors and fixed hollow metal framed openings receiving glass and glazing.
  - 4. Division 8 Section "Curtain Wall": for wood doors vision lites receiving glass and glazing.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Division 01 Section "References". Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 1036 - Flat Glass.
  - 2. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  - 3. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  - 4. Federal Safety Standards for Architectural Glazing Materials 16CFR1201-I.II.

- B. The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. FGMA - Glazing Manual, and Sealant Manual.
  - 2. Consumer Product Safety Commission-Safety Standard for Architectural Glazing Materials.

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Division 01 Section "Submittal Procedures".
  - 1. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
  - 2. Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof
  - 3. Samples:
    - a. 12 by 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
    - b. Glazing tape: 12 inch length of specified type and size.

#### 1.6 QUALITY ASSURANCE:

- A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of three years experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.
- C. Glass Thickness: Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section. Provide units with proper thickness, edge clearance and tolerance to comply with recommendations of glass manufacturer.
- D. Perform work in accordance with FGMA Glazing Manual Sealant Manual.

#### 1.7 EXAMINATION OF SITE AND DOCUMENTS

- A. The bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Subcontractor's failure to familiarize themselves with the contractor documents or site conditions. By submitting a bid, the bidder agrees and warrants that he has had the opportunity to examine the site and the contract documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the contract documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Pre-Bid conference will be held on site; refer to Advertisement for Bids for time and date.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 50°F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and FGMA Manual.
  - 1. Protect materials from moisture, sunlight, excess heat, sparks and flame.
  - 2. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.10 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Laminated Glass:
  - 1. Warranty Period: Manufacturer's standard but not less than 5 years after date of substantial completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 GLASS - GENERAL

- A. General requirements for glass: Of domestic manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after tempering.
  - 1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping. Laminated glass products should not be cut on site.

- C. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

## 2.3 NON-SECURITY GLASS TYPES

- A. Tempered Float Glass; ASTM C 1048, Kind FT, Condition A, Type I, Class 1, tempered by the manufacturer's standard process (after cutting to final size).
  - 1. Thickness: 1/4 inch.
  - 2. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc, Glass Group, Pittsburgh, PA.
    - c. NSG Group, Toledo, OH.
    - d. or equal
- B. Laminated Safety Glass; two sheets of double-strength clear sheet glass; ASTM C 1036, Type I, Class 1, quality q3; permanently laminated together with a minimum 0.030 inch thick sheet of clear plasticized polyvinyl butyl, which has been produced specifically for laminating glass.
  - 1. Thickness: 1/4 inch.
  - 2. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. LTI Group, Pittsfield MA
    - d. or equal
- C. Laminated Noise-Reducing Glass; ASTM C 1036, Type I, applicable Class for glass indicated below, quality q3; provide the following components to produce units of the thickness and light transmittance indicated, tested and certified to provide the indicated STC rating for the sizes required in accordance with ASTM E 90.
  - 1. Exterior Glass: Tempered glass.
  - 2. Laminating Sheet: Acoustic PVB sheet, minimum 0.045 inch thick.
  - 3. Interior Glass: Laminated glass.
  - 4. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. LTI Group, Pittsfield MA
    - d. or equal
- D. Organically Sealed Insulating Glass Units; ASTM C 1036, applicable Type and Class for glass indicated below, quality q3 for Type I glass; manufacturer's standard edge construction of spacers and sealants permanently bonded to glass surfaces and hermetically sealed to provide a dehydrated air space 1/2 inch thick with -60 degrees F. dew point; fabricated of the following glass.
  - 1. Exterior Glass: Tempered float glass.
  - 2. Interior Glass: Laminated glass.
  - 3. Glass Thickness(es): As indicated on the Drawings.
  - 4. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. NSG Group, Toledo, OH.
    - d. LTI Group, Pittsfield, MA

- e. or equal

## 2.4 SINGLE PANE SECURITY GLASS TYPES

- A. Product established as performance standard. Substitution must provide certified independent testing of performance data equal to specified product (see 2.6 for further details).
- B. Security Glazing.
  - 1. Basis-of-Design Product: SG4 by School Guard Glass as manufactured by Laminated Technologies Inc. (844) 744-5277 or equal.
    - a. Security glazing shall have the following characteristics
      - i. No more than 4.1 lbs. per square foot
      - ii. 5-aa1 rated for a minimum of 6 minutes
      - iii. Glass clad on interior and exterior surfaces
      - iv. Optical Haze of no more than 1.8%

## 2.6 SECURITY GLASS TESTING METHODOLOGY FOR “OR EQUAL SUBSTITUTION”

- A. Security Glazing: Security glass and surrounding frames shall demonstrate the ability, through independent third party testing, to provide the following attributes:
  - 1. Products will be tested as a whole system, including glass and doors or frames.
  - 2. Products tested shall be tested in full size, actual doors and framing members usable in a commercial setting, as applicable to project requirements, with security glazing installed as prescribed by the security glazing manufacturer. Testing shall not be done in framing other than what is specified in regards to quality or manufacturer as stated in the Contract Documents.
  - 3. Glass bite during testing shall be no more than the allowable glass bite in the specified door or framing system for this project.
  - 4. The security glass shall resist attack for a minimum of 6 minutes or greater to meet the desired level of protection required by the owner.
  - 5. Attack duration shall be continuous. Breaks between testing phases shall not be counted or timed for total duration.
  - 6. Security glass will be integrated into a framing system in such a way that the frame and glass are able to withstand a constant attack for 6 minutes.
  - 7. Attack resistance shall mean the security glazing is subjected to the following without failure:
    - a. Withstand a minimum of 5 shots from a military style assault rifle with a minimum caliber of 7.62mm.
    - b. Withstand a minimum of abuse as applied by a single assailant at full force and including strikes with feet, bricks, hammers, baseball bats, and sledgehammers without stoppage for 6 or 12 minutes.
  - 8. Failure is defined as a tear in the security glass large enough to allow an object 4-inches in diameter or more to pass through or separation made between the glass and surrounding door frame, storefront or curtain wall framing materials.
  - 9. Product shall not be damaged or scratched by scissors, writing implements, razor blades or the use of any similar sharp object.
  - 10. Glass shall not have an optical haze of more than 1.8% so glass is indistinguishable from standard tempered glass.
- B. Test reports from a recognized independent testing company shall show testing means and methodology consistent or similar to the 5-aa1 assault test.

## 2.7 GLAZING MATERIALS

- A. Glazing Material: Silicone Rubber Glazing Sealant; silicone rubber one-part elastomeric sealant; FS TT-S-001543, Class A; acid-type for non-porous channel surfaces, and nonacid type where any of the channel surfaces are porous.
  - 1. Manufacturers and Products:
    - a. "995" by Dow Corning.
    - b. or equal.
- B. Preformed Butyl Rubber Glazing Sealant; tape or ribbon (coiled on release paper) of polymerized butyl, or mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent-based with minimum 95 percent solids, thread or fabric reinforcement, tack-free within 24 hours, paintable, non-staining.
- C. Molded Neoprene Glazing Gaskets; molded or extruded neoprene gaskets of the profile and hardness required for watertight construction; ASTM D 2000 designation 2BC 415 to 3BC 620.
- D. Pure silicone caulk, closed cell PVC tape, or DAP 33 putty as recommended by Technical Glass Products to comply with U.L. Listing. Must be used for fire-rated glass to meet fire rated labeling requirements.
- E. Colors: For exposed materials provide color as indicated or, if not indicated, as selected by the Director from the manufacturer's standard colors. For concealed materials, provide any of the manufacturer's standard colors.
- F. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.
- G. Spacers: Neoprene, 40-50 durometer hardness, with proven compatibility with glazing materials used.
- H. Compressible Filler Rod: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with glazing materials used, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.
- I. Cleaners, Primers and Sealers: Type recommended by glazing material manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
- C. Determine the actual sizes required by measuring the receiving openings. Size glass and



mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

- D. Perform glazing work in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installations methods.

### 3.2 INSTALLATION

- A. Each installation shall withstand normal temperature changes, applicable wind loading, and impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.
- B. Install glass in accordance with the standards detailed in the "Glazing Manual" of the Glass Association of North America and the "Sealant Manual" of the Flat Glass Marketing Association except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
- C. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
- D. Install glazing materials in accordance with the manufacturer's printed instructions.

### 3.3 GLAZING

- A. Install setting blocks of proper size at quarter points of sill rabbet. If required to keep in place set blocks in thin course of the heel-bead compound.
- B. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light sizes, thickness and type of glass, and complying with manufacturer's recommendations.
- D. Do not cut, seam, nip, or abrade glass which is tempered, heat strengthened, or coated.
- E. Force glazing materials into channel to eliminate voids and to ensure complete "wetting" or bond of glazing material to glass and channel surfaces.
- F. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
- G. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that

gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

- H. Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.

### 3.4 CURE, PROTECTION AND CLEANING

- A. Cure glazing materials in accordance with manufacturer's printed instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability.
- B. Mark glazed openings immediately upon installation of glass by attaching crossed streamers to framing. Do not apply markers of any type to surfaces of glass.
- C. Replace glass included in the work which is broken, or otherwise damaged, from the time Work is started at the site until the date of physical completion.
- D. Maintain glass in a reasonably clean condition during construction to protect from buildup of harmful construction contaminants.
  - 1. Clean and trim excess glazing material from the glass and stops or frames promptly after installation.
- E. When directed, just before Substantial Completion, remove dirt and other foreign material and wash and polish glass included in the work on both sides.

END OF SECTION 088100

## SECTION 088117 – FIRE-RATED GLASS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fire-rated glazing materials installed as vision lights in fire-rated doors.
2. Fire-rated glazing materials installed as sidelites, transoms, and borrowed lites in fire-rated frames.

B. Related Sections include the following:

1. Section 081113 "Hollow Metal Doors and Frames" for vision panels in interior doors and interior vision panel (borrowed lites) frames.
2. Section 081416 "Flush Wood Doors" for vision panels in interior doors.

#### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E 119: Fire Tests of Building Construction and Materials.

B. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):

1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.

F. Underwriters Laboratories, Inc. (UL):

1. UL 263: Fire tests of Building Construction and Materials
2. UL 9 – Fire Tests of Window Assemblies
3. UL 10B – Fire Tests of Door Assemblies
4. UL 10c – Positive Pressure Fire Tests of Door Assemblies

G. Standard Council of Canada:

1. ULC Standard CAN4-S104: Fire Tests of Door Assemblies.

- 2. ULC Standard CAN4-S106: Fire Tests of Window Assemblies.
- 3. CAN/ULC-S101M: Standard Methods of Fire Endurance Tests.
- H. International Building Code, 2015 Edition.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Fire-rated glass ceramic clear and wireless glazing material listed for use in non-impact safety-rated locations such as transoms and borrowed lites with fire rating requirements ranging from 20 to 90 minutes with hose stream test.
- B. Fire-rated, clear and wireless glazing material for use in locations such as doors, sidelites, transoms, borrowed lites, and wall applications with fire rating requirements ranging from 45 minutes to 2 hours with required hose stream test; for use in interior and exterior applications.
- C. Provides protection by reducing the radiant and conductive heat transfer
- D. Passes positive pressure test standards UBC 7-2 and UBC 7-4.

### 1.4 SUBMITTALS

- A. Comply with requirements of Section 013300.
- B. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- E. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated.

### 1.5 QUALITY ASSURANCE

- A. Glazing Standards: GAMA and FGMA Glazing Manual and Sealant Manual.
- B. Fire Resistance Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire resistive assemblies.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials under provisions of Section 016000.
- B. Deliver materials to specified destination in manufacturer or distributor's packaging, undamaged, complete with installation instructions.

- C. Pilkington Pyrostop® must not be exposed outside the range -40 degrees F to 120 degrees F (-40-degree C to +50 degrees C) during storage and transportation.
- D. Store off ground, under cover, protected from weather and construction activities.
- E. Do not expose the non-PVB side of glass to UV light.
- F. Store sheets of glass vertically. DO NOT lean.

## 1.7 WARRANTY

- A. Technical Glass Products warrants only that the product will be free of manufacturing defects resulting in materials obstruction through the glass area and/or edge separation and changes in properties of the interlayer for a period of five (5) years from the date of purchase, provided the products have been properly shipped, stored, handles, installed, and maintained. The remedy for product proved to be defective under the terms of this warranty is limited to shipment of replacement product. With respect to all claims under this warranty, Technical Glass Products shall have the right to inspect any and all products alleged to be defective.
- B. Provide manufacturer's limited warranty under provision of section 016000.

## PART 2 - PRODUCTS

### 2.1 FIRE GLASS 20 (20 MINUTE RATED)

- A. Manufacturer: Basis of Design: Fireglass 20 as manufactures by J.R. Four Ltd., and distributed by Technical Glass Products, Kirkland, Washington, voice 1-800-426-0279, fax 1-800-451-9857, e-mail [sales@fireglass.com](mailto:sales@fireglass.com), website [www.fireglass.com](http://www.fireglass.com).
- B. Properties:
  - 1. Thickness: ¼ "
  - 2. Weight: 3.0 lbs./sq.ft.
  - 3. Approximate Visible Transmission: 89%
  - 4. Approximate Visible Reflection: 8%
  - 5. Fire-rating: 20 minutes ( WITHOUT HOSE STREAM TEST)
  - 6. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II)
- C. Labeling: Permanently label each piece of fireglass 20 logo, UL logo and fire rating in sizes up to 6,396 SF.
- D. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with [ASTM E2074-00] [NPFA 252] [UL 9, UL 10B and UL 10C].
- E. Substitutions: Architect Approved Equal.

### 2.2 FIRE-RATED GLAZING MATERIALS (45 MINUTE - 2 HOUR RATED)

- A. Manufacturer: Pilkington Pyrostop® as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA

98065, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, Web site www.fireglass.com.

- B. Composition: Composed of multiple sheets of "Optiwhite" high visible light transmission glass laminated with an intumescent interlayer. [Most configurations are available with a translucent interlayer for added obscurity and privacy.]
- C. Properties:
  - 1. Thickness: For Interior Use: 3/4", #45-200, 7/8", #60-101, 1-1/16" #60-201, 1-7/16, #90-102, 2-1/8", #120-104 2-1/4", #120-106 2-13/16", #120-401.
  - 2. Weight: Varies with thickness (approximate range 9 to 22 lbs./sq. ft.).
  - 3. Approximate Visible Transmission: Varies with thickness (approximate range 88 to 75 percent).
  - 4. Fire-rating: Up to 2 hours.
  - 5. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
  - 6. STC Rating: Up to 46 dB.
  - 7. Exterior Grade: PVB layer on exterior surface.
- D. Permanently label each piece of Pilkington Pyrostop® with the appropriate marking.
- E. Fire Rating – 60 Minutes and Greater: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E 119 and UL 263.
- F. Substitutions: Architect Approved Equal.

## 2.3 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal.
- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
  - 1. Dow Corning 795 - Dow Corning Corp.
  - 2. Silglaze-II 2800 - General Electric Co.
  - 3. Spectrem 2 - Tremco Inc.
- C. Setting Blocks: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.
- D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
- E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

## 2.4 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
  - 2. Minimum required face or edge clearances.
  - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

### 3.2 INSTALLATION (GLAZING)

- A. Comply with referenced GANA and FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- D. Place setting blocks located at quarter points of glass with edge block no more than 6-inches from corners.
- E. Glaze vertically into labeled fire-rated metal frames or partition walls with the same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- F. Place glazing tape on free perimeter of glazing in same manner described above.
- G. Do not remove protective edge tape.
- H. Install removable stop and secure without displacement of tape.
- I. Do not pressure glaze.
- J. Glaze exterior openings with PVB layer toward the exterior of the building.
- K. Knife trim protruding tape.

- L. Apply cap bead of silicone sealant along void between the stop and the glazing, to uniform line, with bevel to form watershed away from glass. Tool or wipe sealant surface smooth.
- M. Provide minimum 3/16 inch edge clearance.
- N. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- O. Install so that appropriate UL and Pilkington Pyrostop® markings remain permanently visible.

### 3.3 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

NOTE: SEE GLAZING SCHEDULE ON FOLLOWING PAGES



### 3.4 GLAZING SCHEDULE

#### A. Interior Use:

Fire Rating	Manufacturer Designation	Supply Form	Thickness	Weight Approx.	U-Value	Daylight Trans. Approx. (%)	STC Rating Approx. (dB)	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	or	Max. Height Of Exposed Glazing (In.)
20 min.	Fire Glas 20	Single Glazing	1/4"	3.0 lb/ ft2	.89	89	40	Door	3,204	36		89
45 min.	45-200	Single Glazing	3/4" (19 mm)	9.22 lb / ft2 (45.00 kg / m2)	.86	86	40	Other than doors Door	4,500 3,724	95-1/4 41-5/8		95-1/4 89-3/4
60 min.	60-101	Single Glazing	7/8" (23 mm)	10.86 lb / ft2 (53.00 kg / m2)	.83	87	41	Other than doors Door	5,616 3,724	96 41-5/8		96 89-3/4
60 min.	60-201	Single Glazing	1-1/16" (27 mm)	12.90 lb / ft2 (63.00 kg / m2)	.83	86	44	Other than doors Door	7,442 3,724	96 41-5/8		118-1/4 89-3/4
90 min.	90-102	Single Glazing	1-7/16" (37 mm)	17.61 lb / ft2 (86.00 kg / m2)	.74	84	45	Other than doors Door	3,724 3,724	96 41-5/8		96 89-3/4
2 hr.	120-104	I.G. Units	2-1/8" (54 mm) [with 8 mm spacer, or 2-3/8" (60 mm) with 14 mm spacer]	21.71 lb / ft2 (106.00 kg / m2)	.44	75	46	Other than doors	3,730	111		111
2 hr.	120-106	I.G. Units	2-1/4" (57 mm)	22.94 lb / ft2 (112.00 kg / m2)	.42	75	46	Other than doors	3,730	111		111

B. Exterior Use:

Fire Rating	Manufacturer Designation	Supply Form	Thickness	Weight Approx.	U-Value	Daylight Trans. Approx. (%)	STC Rating Approx. (dB)	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	or	Max. Height Of Exposed Glazing (In.)
45 min.	45-200	Single Glazing	3/4" (19 mm)	9.22 lb / ft <sup>2</sup> (45.00 kg / m <sup>2</sup> )	.86	86	40	Other than doors Doors	4,500 3,724	95-1/4 41-5/8		95-1/4 89-3/4
45 min.	45-260	I.G. Units	1-5/16" (33 mm)	12.29 lb / ft <sup>2</sup> (60.00 kg / m <sup>2</sup> )	.49	77	40	Other than doors Door	4,500 3,724	95-1/4 41-5/8		95-1/4 89-3/4
45 min.	45-360*	I.G. Units	1-5/16" (33 mm)	12.29 lb / ft <sup>2</sup> (60.00 kg / m <sup>2</sup> )	.37- .39	59-71	40	Other than doors Doors	4,500 3,724	95-1/4 41-5/8		95-1/4 89-3/4
60 min.	60-201	Single Glazing	1-1/16" (27 mm)	12.90 lb / ft <sup>2</sup> (63.00 kg / m <sup>2</sup> )	.83	86	44	Other than doors Door	7,442 3,724	96 41-5/8		118-1/8 89-3/4
60 min.	60-261	I.G. Units	1-5/8" (41 mm)	15.98 lb / ft <sup>2</sup> (78.00 kg / m <sup>2</sup> )	.48	77	44	Other than doors Door	7,442 3,724	96 41-5/8		118-1/8 89-3/4
60 min.	60-361*	I.G. Units	1-5/8" (41 mm)	15.98 lb / ft <sup>2</sup> (78.00 kg / m <sup>2</sup> )	.37- .39	59-70	44	Other than doors Door	7,442 3,724	96 41-5/8		118-1/8 89-3/4
90 min. -2 hr.	120-202	Single Glazing	1-9/16 (40 mm)	18.64 lb / ft <sup>2</sup> (91.00 kg / m <sup>2</sup> )	.72	86	46	Door	3,724	41-5/8		89-3/4
90 min. -2 hr.	120-262	I.G. Units	2-3/8" (60 mm) [with 14 mm spacer, or 2-1/8" (54 mm) with 8 mm spacer]	21.71 lb / ft <sup>2</sup> (106.00 kg / m <sup>2</sup> )	.44	74	46	Other than doors	3,730	111		111

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088117-8  
ADD NO. 1

Mamaroneck UFSD/2019 Bond Referendum  
Capital Improvements at Chatsworth Avenue School  
NYSED # 66-07-01-03-0-005-020

90 min. - 2 hr.	120-362*	I.G. Units	2-3/8" (60 mm) [with 14 mm spacer, or 2-1/8" (54 mm) with 8 mm spacer]	21.71 lb / ft <sup>2</sup> (106.00 kg / m <sup>2</sup> )	.35	33-68	46	Other than doors	3,730	111	111
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*\*Performance values vary for exterior I.G. units based upon the coating on surface #2. Coatings available are Eclipse Advantage Clear, Solar-E™ Solar Control Low-E and Energy Advantage Low-E. Length/thickness tolerances available upon request.*

WHEN PROVIDED PROJECT-SPECIFIC CRITERIA (SUCH AS WIND LOAD, SEISMIC MOVEMENT, STRUCTURAL, AIR/WATER RESISTANCE, ETC.), TGP CAN VERIFY THE INTENDED FENESTRATION CONFIGURATION (GLASS AND FRAMING) WILL PERFORM TO MEET THOSE REQUIREMENTS. FOR APPROVED FRAMING SYSTEMS FOR USE WITH PILKINGTON PYROSTOP, VISIT FIREGLASS.COM OR CALL 800.426.0279.

END OF SECTION

END OF SECTION 088117



## SECTION 089000 – LOUVERS AND VENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Fixed, extruded-aluminum louvers.

#### 1.03 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
  - 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  2. AWS D1.3, "Structural Welding Code - Sheet Steel."
  3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

#### 1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.02 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide extended sills for recessed louvers.

## 2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

### A. Horizontal, Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Arrow United Industries; a division of Mestek, Inc.
  - b. Carnes Company, Inc.
  - c. Greenheck Fan Corporation.
  - d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
  - e. Ruskin Company; Tomkins PLC.
  - f. United Enertech Corp.
2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.081 inch for blades and 0.081 inch for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
  - a. Free Area: Not less than 54% for 48-inch- wide by 48-inch- high louver.
  - b. Point of Beginning Water Penetration: Not less than 870 fpm.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.04 LOUVER SCREENS

### A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

### B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

### C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.

### D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Flattened, expanded aluminum, 5/8 by 0.040 inch thick.

## 2.05 FINISHES, GENERAL

- ### A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.03 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required.

### 3.04 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000



## SECTION 090561 – WATER VAPOR EMISSION CONTROL SYSTEM FOR CONCRETE SLABS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Testing and application of systems for the reduction of moisture vapor transmission and alkalinity control for interior concrete slabs scheduled for floor finish of VCT, vinyl flooring, rubber flooring, wood, carpet, and/or epoxy flooring systems.

#### 1.2 RELATED SECTIONS

- A. Section 033000 - Cast-In Place Concrete: Installation and curing requirements according to ACI 302.
- B. Section 096513 – Rubber stair treads.
- C. Section 096520 – Tile Flooring Including Vinyl Enhanced Tile

#### 1.3 REFERENCES

- A. American Society of Testing and Materials (ASTM):
  - 1. C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
  - 2. C 348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
  - 3. D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
  - 4. E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - 5. F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Floor Using Anhydrous Calcium Chloride.
  - 6. F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- B. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete; Surface Preparation for Sealers, Coatings and Polymer Overlays.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's specification.
  - 2. Installation instructions.

3. Independent test data.
  4. Certification requirements.
  5. Warranty information.
- C. Pre-Construction Testing: Submit anhydrous calcium chloride test results. Test shall be performed according to ASTM F 1869. Test shall be performed by the General Contractor and submitted to the Architect, and manufacture's site representative.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

## 1.5 QUALITY ASSURANCE

### A. Manufacturer Qualifications:

1. Manufacturer shall have no less than five years experience in manufacturing water vapor reduction systems. The water vapor reduction system shall be specifically formulated and marketed for water vapor reduction and alkalinity control. System design shall provide protection from vapor emission rates less than or equal to 20 pounds per 1000 square feet per 24 hours and/or 98% relative humidity.

### B. Installer Qualifications:

1. Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.
2. Installer shall have no less than five years experience installing the specified fluid based coating systems.

### C. Product Performance History:

1. Manufacturer shall provide independent lab test reports documenting performance per the following:
  - a. ASTM E 96, Water Vapor Transmission (wet methods) Performance shall be documented by an independent testing laboratory indicating a minimum of 90 percent water vapor transmission reduction compared to untreated concrete.
  - b. ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
  - c. Certify acceptance and exposure to continuous topical water contact after final cure.
2. Submit list of product use and performance history, for the same formulation and system design, listing reference sources. Similar projects shall have documented minimum initial water vapor transmission rates of 20 lb per 1000 sf per 24 hours to 3 lb per 1000 sf per 24 hours, and have resulted in maintained water vapor reduction rate of less than 3 lb per 1000 sf per 24 hours when tested according to ASTM F1869.

- D. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
- B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 degrees F (32 degrees C) or below 50 degrees F (10 degrees C).
- C. Handle product in a manner that will prevent breakage of containers and damage products.

#### 1.7 PROJECT CONDITIONS

- A. Select a floor covering system scheduled for the treated concrete substrate having the ability to withstand water vapor transmission levels up to 3 lb per 1000 sf (1.5 kg/100 sq. m) /24 hours.
- B. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
  1. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
  2. Do not apply water vapor reduction system when temperature is lower than 50 degrees F (10 degrees C) or expected to fall below this temperature within 24 hours from time of application.
  3. Allow continuous ventilation and indirect air movement at all times during application and curing process of the water vapor reduction system.
  4. Protection: Protect water vapor reduction system to prevent damage from active rain or surface water for a minimum of 24 hours from time of application.

#### 1.8 SCHEDULING

- A. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet and/or epoxy flooring systems over the interior concrete slabs, anhydrous calcium chloride testing shall be performed per ASTM F 1869 or ASTM F 2170 by the General Contractor to determine the level of water vapor transmission or relative humidity in the slab and the application rate of the moisture vapor reduction system required.
- B. The General Contractor will coordinate the scheduling of the water vapor reduction system testing, allowing adequate time to test, review results and determine the water vapor reduction system application rate before installation of floor finish is required.
- C. The General Contractor will allow a reasonable period of time (Minimum of 3 days) for the

concrete slab to cure and dry before performing anhydrous calcium chloride tests. All mastics, glues, curing compounds and contaminants shall be removed to provide a clean, sound, concrete substrate prior to performing anhydrous calcium chloride tests.

#### 1.9 WARRANTY

- A. Manufacturer shall provide the Owner with a system warranty including adhesives and surface preparation products for a period of no less than ten years at no additional cost.
- B. Installer of water vapor reduction system shall provide standard installation warranty for workmanship.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: CHAPCO / H.B. Fuller Construction Products Inc.: 1105 S. Frontenac Street, Aurora, IL 60504, email: [charlie.renner@hbfuller.com](mailto:charlie.renner@hbfuller.com), web: <http://chapco-adhesive.com>
- B. Substitutions: As approved by Architect.

#### 2.2 SYSTEM

- A. Single Coat System: 2-component, VOC Compliant, Low viscosity, 100 percent solid epoxy formulated as a vapor barrier against high moisture and alkalinity in concrete substrates. The water vapor reduction system shall, after final cure, reduce vapor emissions from a maximum of 98 percent relative humidity and alkalinity reduction to acceptable pH levels.
  - 1. Product: CHAPCO'S DEFENDER as manufactured by CHAPCO / H.B. Fuller Construction Products, Aurora, IL.
  - 2. A Single Coat System consists of one coat of CHAPCO'S DEFENDER coating to be applied to a properly prepared concrete surface at an application rate determined by an anhydrous calcium chloride tests or RH in situ probes.
  - 3. Mix Component A and B at a ratio per manufacturers strict instructions.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.2 PREPARATION

- A. Inspect surfaces with manufacturer's representative to determine its suitability to receive the moisture vapor reduction system. Provide an uncontaminated, sound surface.
- B. Clean surfaces to receive moisture vapor reduction system. Shot blast floors and clean

surfaces to remove residue from the substrate. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast abrasive residue, etc.

- C. Repair cracks, expansion joint, control Joints, and open surface honeycombs.
  - 1. Use CHAPCO'S DEFENDER mixed 1:1 by volume with clean, white fine silica sand. Force mixture into cracks and joints with a trowel or putty knife. Comply with requirements listed in manufacturer's technical data information. No exceptions. Consult with vapor reduction manufacturer.
- D. Verify that surfaces to be treated with moisture vapor reduction system have not previously been treated with materials such as underlayments, screeds, penetrating sealants, etc.
  - 1. Consult with vapor reduction system manufacturer prior to application.
- E. Verify if concrete additives such as chlorides or other soluble compounds that may contaminate surfaces have been used in the concrete mix.
  - 1. Consult with vapor reduction system manufacturer prior to application.
- F. Do not acid etch surface.
- G. Verify that the substrate surface does not deteriorate due to the presence of sulphurous compounds or alkaline aggregate/silica reaction encountered in certain areas.
  - 1. Consult with vapor reduction system manufacturer prior to application.
  - 2. Testing for concrete deficiencies / contamination such as alkaline silica reaction, untreated silicates, organic residue, etc. is the responsibility of the General Contractor.
- H. The surface substrate shall remain uncontaminated, absorptive, and sound prior to receiving a water vapor reduction system. Comply with all requirements as listed in manufacturer's technical data information. No exceptions.

### 3.3 APPLICATION

- A. Single Coat System Application:
  - 1. The coverage rates for the Single Coat System are dependant on the surface texture and porosity of the substrate.
  - 2. Required Application Rate Relative to Existing Levels of Moisture Vapor to Achieve 3 lb/1000 sf / 24 hours Moisture Levels:
    - a. Up to 20 lb/1000 sf / 24 hr: 130-180 s / gallon.
  - 3. Apply one coat of CHAPCO'S DEFENDER™ Moisture Vapor Barrier using a squeegee. Allow 5 minutes for surface to "off gas". Back roll CHAPCO'S DEFENDER with a 3/8 inch (9.5 mm) nap roller to achieve uniform, continuous application of membrane. Allow the minimum cure time before installing the finish flooring.

### 3.4 TESTING

A. Initial Tests:

1. Anhydrous calcium chloride testing shall be performed by the installer.
2. Provide initial anhydrous calcium chloride tests according ASTM F 1869 to the prepared concrete surfaces. Tests shall be performed on properly prepared concrete. No exceptions!
3. Conduct calcium chloride tests at the same temperature and humidity as designed normal occupancy. If this is not possible, test conditions shall be 75 degrees F +/-10 degrees (24 degree C +/- 5 degrees) and 50 percent +/-10 percent relative humidity. Maintain these conditions 48 hours prior to and during tests. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature are not acceptable.
4. Installer shall provide test results with a marked up floor finish plan showing test results. General Contractor shall provide a written clarification on status of the ambient air temperature and humidity before and during the testing procedures.
5. Installer shall provide a marked up floor plan showing areas with vapor reduction system recommendations.

B. Post-Treatment / Pre-Flooring Tests:

1. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet, and / or epoxy flooring systems and after proper cure of the final coat of the water vapor reduction system provide anhydrous calcium chloride tests according ASTM F 1869. Allow the vapor mitigation system to cure 72 hours before performing test. Water vapor transmission and alkalinity tests shall be performed on properly treated concrete. No exceptions!
2. The installer shall provide test results of the level of water vapor transmission and alkalinity of the concrete slab to all parties involved. The flooring manufacturer and installer shall accept the floor condition and certify that the flooring application materials and methods are compatible with the test results and floor condition.

C. Adhesion

1. The flooring installer shall verify the usage of CHAPCO Multipurpose Primer prior to the installation of any patches or floor prep materials. Non permeable flooring systems require the application of a cementitious skim coat, such as CHAPCO SmoothFinish™, entirely covering CHAPCO'S DEFENDER and Multipurpose Primer prior to the installation of Floor Covering.

3.5 CLEANING

- A. Remove all debris resulting from water vapor reduction system installation from project site.

3.6 PROTECTION

- A. Protect each coat during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION 090561

## SECTION 092900 – GYPSUM BOARD

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Exterior gypsum board for ceilings and soffits.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry"

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
  - 2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

#### 1.04 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Install mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
    - b. Each texture finish indicated.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.05 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

## 1.06 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Moisture- and Mold-Resistant Assemblies: Provide and install moisture- and mold-resistant glass-mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C 1658 and ASTM C 1177 where indicated on Drawings and in all locations which might be subject to moisture exposure during construction. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.02 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.



## 2.03 INTERIOR GYPSUM BOARD

- A. Basis-of-Design Product: The design for each type of gypsum board and related products is based on Georgia-Pacific Gypsum products named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. American Gypsum.
  2. CertainTeed Corp.
  3. Lafarge North America Inc.
  4. National Gypsum Company.
  5. PABCO Gypsum.
  6. Temple-Inland.
  7. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus High-Performance Interior Panel.
  2. Thickness: 1/2 inch.
  3. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus Fireguard High-Performance Interior Panel.
  2. Thickness: 5/8 inch.
  3. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.
1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus Abuse-Resistant Panel
  2. Thickness: 5/8 inch.
  3. Long Edges: Tapered.
- E. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus Impact-Resistant Panel.
  2. Thickness: 5/8 inch.
  3. Long Edges: Tapered.
  4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.04 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.

- c. LC-Bead: J-shaped; exposed long flange receives joint compound.
- d. L-Bead: L-shaped; exposed long flange receives joint compound.
- e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fry Reglet Corp.
  - b. Gordon, Inc.
  - c. Pittcon Industries.
- 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
- 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.05 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

- 1. Interior Gypsum Board: Paper.
- 2. Exterior Gypsum Soffit Board: Paper.
- 3. Exterior Glass Mat Gypsum Soffit: Fiberglass mesh.
- 4. Glass-Mat Gypsum Wallboard: 10-by-10 fiberglass mesh.
- 5. Glass-Mat Gypsum Sheathing Board: 10-by-10 fiberglass mesh.
- 6. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

- 1. Prefilling: At open joints rounded or beveled panel edges and damaged surface areas, use setting-type taping compound.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound or ToughRock Sandable Setting Compound.
- 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound.
  - b. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound, high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.

## 2.06 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    - b. Grabber Construction Products; Acoustical Sealant GSC.
    - c. Pecora Corporation; [AC-20 FTR] [AIS-919].
    - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    - e. USG Corporation; SHEETROCK Acoustical Sealant.
  2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: As indicated on Drawings.
  - 2. Type X: As indicated on Drawings.
  - 3. Abuse-Resistant Type: As indicated on Drawings.
  - 4. Impact-Resistant Type As indicated on Drawings.
- B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

### 3.04 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. Bullnose Bead: Use at outside corners.

3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.

### 3.05 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints rounded or beveled edges and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Panels that are substrate for tile.
  3. Level 3: Where indicated on Drawings.
  4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  5. Level 5: Where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### 3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900





## SECTION 093019 – PORCELAIN WALL TILE

### PART 1 - GENERAL

#### 1.1 SUMMARY

#### 1.2 SECTION INCLUDES

- A. Porcelain wall tile

#### 1.3 REFERENCE STANDARDS

- A. ANSI A108.1A -- American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
- B. ANSI A108.4 -- Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
- C. ANSI A108.6 -- Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.
- D. ANSI A108.10 -- Installation of Grout in Tilework.
- E. ANSI A118.3 -- American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive.
- F. ANSI A118.6 -- American National Standard Specifications for Ceramic Tile Grouts.
- G. ANSI A118.8 -- American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout.
- H. ANSI A136.1 -- American National Standard for Organic Adhesives for Installation of Ceramic Tile.
- I. ANSI A137.1 -- American National Standard Specifications for Ceramic Tile.
- J. ASTM A 82 -- Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- K. ASTM A 185 -- Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- L. ASTM C 503 -- Standard Specification for Marble Dimension Stone (Exterior).
- M. ASTM C 920 -- Standard Specification for Elastomeric Joint Sealant.
- N. ASTM E 90 -- Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- O. Handbook for Ceramic Tile Installation; Tile Council of America, Inc. (TCA).

#### 1.4 SUBMITTALS

- A. Submit samples of each type/style/finish/size/color of porcelain tile under provisions of Section 013300 & 014000.
- B. Submit the following Samples for Verification Purposes:

1. Submit each tile type selected mounted on a minimum 24-inch square board with joints filled using selected grout.
  2. Trim and accessories: Samples of actual units in selected color.
  3. Saddles and/or thresholds: 6-inch-long samples.
  4. Edge strips: 6-inch long samples.
- C. Submit manufacturers' installation instructions under provisions of Section 013300 & 014000.
- D. Shop Drawings: Showing tile layout and details of expansion joints in tile work and underlying construction.
- E. Submit manufacturer's certification that materials supplied conform to ANSI A137.1.
- F. Submit proof of warranty.
- G. Qualifications Documentation: Written confirmation that companies executing work in this section comply with experience requirements.

#### 1.5 QUALITY ASSURANCE

- A. Tile Manufacturer: Company or Affiliate Company specializing in ceramic tile, mosaics, pavers, trim units and/or thresholds with five (5) years minimum experience. Obtain tile from a single source with resources to provide products of consistent quality in appearance and physical properties.
- B. Installer: A company with not less than (20) installations of tile work similar in size and complexity to the work of this project.

#### 1.6 MOCK-UPS

- A. Provide mock-up of each type/style/finish/size/color of ceramic tile, mosaics, pavers, trim unit and threshold, along with respective installation adhesives, mortars, grouts and other installation materials, under provisions of Section 013300 & 014000.

#### 1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-installation conference: At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions.
- B. Representatives of owner, architect, general contractor, tile subcontractor, and any other parties who are involved in the scope of this installation must attend the meeting.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at Site: deliver and store packaged materials in original containers with seals unbroken and labels, including grade seal, intact until time of use, in accordance with manufacturer's instructions.
- B. Store porcelain tile and installation system materials in a dry location; handle in a manner to prevent chipping, breakage, and contamination.

#### 1.9 MAINTENANCE

- A. Submit maintenance data under provisions of Section 01730. Include cleaning methods, cleaning solutions recommended, stain removal methods, as well as polishes and waxes recommended.

#### 1.10 EXTRA MATERIALS STOCK

- A. Upon completion of the work of this Section, deliver to the owner 5% minimum additional tile and trim shape of each type, color, pattern and size used in the work, as well as extra stock of adhesives, mortars, grouts and other installation materials for the owner's use in replacement and maintenance. Extra stock to be from same production run or batch as original tile and installation materials.

### PART 2 - PRODUCTS

#### 2.01 TILE MANUFACTURERS

Basis of Design: Provide products by the following manufacturers or a preapproved equivalent:

- A. Manufacturer: Aphelion Collection  
Phone: 844-245-0686  
Email: [sales@aphelioncollection.com](mailto:sales@aphelioncollection.com)  
Website: [www.aphelioncollection.com](http://www.aphelioncollection.com)
- B. Contact: Christopher Capobianco – Spartan Surfaces  
[christopher@spartansurfaces.com](mailto:christopher@spartansurfaces.com)

#### 2.02 WALL TILE

- A. Brand: Aphelion
- B. Style: Bianca
- C. Colors: Jupiter, Atmosphere, Interstellar, Titan, Stardust
- D. Finish: matte
- E. Field tile sizes: 6" x 24, 12" x 24"
- F. Trim: Bullnose 3" x 12"

#### 2.03 SETTING MATERIALS

- C. Portland Cement Mortar Installation Materials: ANSI A108.1A.

- 1. Setting bed reinforcing: Galvanized welded wire fabric, 2 inches by 2 inches, ASTM A 185; with W0.3 by W0.3, 0.0625 inch diameter, wire, ASTM A 82 except for minimum wire size.

- B. Chemical-Resistant, Water-Cleanable Porcelain Tile Setting and Grouting Epoxy: ANSI A118.3.

- 1. Service temperature: Product recommended and certified by manufacturer to resist anticipated ambient temperature range, but not less than 140 F degrees on a continuous basis.

- 2. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:

- a. American Olean Tile Company.
- b. Boiardi Products Corporation.
- c. C-Cure Corporation.
- d. Mapei Corporation.
- e. Laticrete International, Inc.
- f. Southern Grouts & Mortars, Inc.
- g. Summitville Tiles, Inc.
- h. Tamms Industries.

C. Organic Adhesive: ANSI A136.1 for Type I and Type II, as each applies to the indicated installation.

1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
  - a. American Olean Tile Company.
  - b. Boiardi Products Corporation.
  - c. Bostik Inc.
  - d. Custom Building Products.
  - e. C-Cure Corporation.
  - f. Tec Incorporated/H. B. Fuller Company.
  - g. Jamo, Inc.
  - h. Mapei Corporation.
  - i. Southern Grouts & Mortars, Inc.
  - j. Tamms Industries.

## 2.04 WATERPROOFING MATERIALS

A. Sheet Membrane: 0.030 inch thick chlorinated polyethylene (CPE) sheet with nonwoven polyester laminated to both sides, 60 inches wide.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
  - a. "NobleSeal TS"; The Noble Company.
  - b. "Dal-Seal TS"; Dal-Tile Corporation.
  - c. "Redgard" by Custom Building Products

## 2.05 GROUTING MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10.

B. Chemical-Resistant Epoxy Grout: ANSI A118.3.

1. Service temperature: Product recommended and certified by manufacturer to resist anticipated ambient temperature range, but not less than 140 F degrees on a continuous basis.
2. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
  - a. American Olean Tile Company.
  - b. Atlas Mineral & Chemicals, Inc.
  - c. Boiardi Products Corporation.
  - d. Bostik Inc.
  - e. C-Cure Corporation.
  - f. Mapei Corporation.
  - g. Laticrete International, Inc.
  - h. Southern Grouts & Mortars, Inc.
  - i. Summitville Tiles, Inc.
  - j. Tamms Industries.

## 2.06 ELASTOMERIC SEALANTS

A. Compatibility: Provide sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates for project performance conditions.

- B. Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and O (for nonporous substrates) with added fungicide.
  - 1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
    - a. Dow Corning Corporation.
    - b. GE Silicones.
    - c. Pecora Corporation.
    - d. Tremco, Inc.
- C. Urethane Sealant: ASTM C 920, Grade P; Class 25; Uses T, M, and A.
  - 1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
    - a. Bostik Inc.
    - b. Mameco International, Inc.
    - c. Pecora Corporation.
    - d. Tremco, Inc.
- D. Chemical-Resistant Sealants: Sealants recommended by tile setting materials manufacturer to be compatible with and have similar chemical resistant performance as the chemical-resistant mortar and grout.
  - 1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
    - a. Atlas Mineral & Chemicals, Inc.

## 2.07 MISCELLANEOUS MATERIALS

- A. Edge strips; fabricated from the following material with 1/8 inch wide exposed edge, and means for securing strip to substrate:
  - 1. Zinc alloy.
  - 2. Stainless steel.
- B. Tile Cleaner: Product specifically acceptable to tile manufacturer and grout manufacturer for application indicated and as recommended by National Tile Promotion Federation or Ceramic Tile Institute.
  - 1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
    - a. Hillyard, Inc.
    - b. Mapei Corporation.

## 2.08 MIXING MORTAR AND GROUT

- A. Mix mortar and grout to comply with referenced standards and manufacturer's mixing procedures.

## PART 3 – EXECUTION

### 3.1 SUBSTRATE EXAMINATION

- A. Verify that surfaces to be covered with tie are:

1. Sound, rigid and conform to good design/engineering practices;
2. With maximum deflection under all live, dead and impact loads, including concentrated loads, of L/360 for ceramic tile, mosaics, pavers or brick;
3. Clean and free of dust, dirt, oil, grease, sealers, curing compounds, laitance, efflorescence, form oil or loose plaster, paint and scale;
4. Not leveled with gypsum or asphalt-based compounds;
5. In accordance with ANSI 108.01 – Subsurfaces and Preparation by Other trades.

### 3.2 SURFACE PREPARATION

#### A. GENERAL PREPARATION

1. Building temperature of 70°F to have been maintained for 5 days prior to the start of installation and all material is to have been acclimatized in the building for 72 hours.

### 3.3 INSTALLATION – TILE

- A. General: Install in accordance with current versions of American National Standards Institute, Inc. (ANSI) “A108 American National Standard for Installation of Ceramic Tile” and TCA “Handbook for Ceramic Tile Installation both to be the most current version.” Cut and fit ceramic tile, brick or stone neatly around corners, fittings, and obstructions. Perimeter pieces to be minimum half tile, brick or stone. Chipped, cracked, split pieces and edges are not acceptable. Make joints even, straight, plumb and of uniform width to tolerance +/- 1/16 over 8' (1.5mm in 2.4m). Install divider strips at junction of flooring and dissimilar materials.
- B. Per Tile Council of North America (TCNA) Handbook.
- C. Tile to be installed in a running bond offset at a maximum of 33% with minimum 3/16” grout joint.

### 3.5 CLEANING

- A. Clean excess mortar/epoxy from veneer surfaces with water before they harden and as work progresses. Do not contaminate open grout/caulk joints while cleaning. Sponge and wash veneers diagonally across joints. Do not use acids for cleaning. Polish with clean dry cloth. Remove surplus materials and leave premises broom clean.
- B. Follow manufacturer’s recommendation for protection during installation and grouting as well as recommendations for routine and heavy-duty maintenance of porcelain tiles.

## PART 4 – HEALTH AND SAFETY

- A. The use of personal protection such as rubber gloves, suitable dust masks, safety glasses and industrial clothing is highly recommended. Discarded packaging, product wash and waste water should be disposed of as per local, state or federal regulations.

END OF SECTION 093019

## SECTION 095113 – ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes acoustical tiles for ceilings and the following:
  - 1. Concealed suspension systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

#### 1.03 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.

2. Concealed Suspension System Members: 12-inch- (300-mm-) long Sample of each type.
  3. Exposed Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type and color.
- E. Qualification Data: For testing agency.
  - F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.
  - G. Research/Evaluation Reports: For acoustical tile ceiling and components and anchor type.
  - H. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.05 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
  1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
  2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Acoustics: Acoustical Ceiling Tiles provided for classrooms and meeting rooms shall have a minimum NRC rating of .65
- D. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
  1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
  2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.



- E. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. 2015 International Building Code New York Edition.
- F. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
  - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

#### 1.07 COORDINATION

- A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size units equal to 5.0 percent of quantity installed.
  - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.02 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Tile-Based Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.
- D. All finishes as scheduled on Drawing A5.00 for ceiling types.

## 2.03 ACOUSTICAL TILES TYPES

- A. Refer to Drawing A5.00 for Ceiling Types.

## 2.04 METAL SUSPENSION SYSTEMS

- A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
  - 1. Structural Classification: ASTM C 635 Intermediate Duty.
  - 2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise in specifications or on drawings.
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.
- D. Basis of Design Product:
- E. Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries.
- F. Basis of Design Product: Superfine 9/16" Exposed Tee as manufactured by Armstrong World Industries.
- G. Basis of Design Product: Armstrong Drywall Grid Suspension System.

H. Or Equal Products by the following:

1. Chicago Metallic Corporation.
2. Fry Reglet Corporation.
3. Gordon, Inc.
4. MM Systems, Inc.
5. USG Interiors, Inc.

I. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

J. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:

1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
  - a. Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

## 2.05 ACOUSTICAL SEALANT

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:
  - a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
  - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
2. Acoustical Sealant for Concealed Joints:
  - a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
  - b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
  - c. Pecora Corp.; BA-98.
  - d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## 2.06 MISCELLANEOUS MATERIALS

- A. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

### 3.03 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical tile ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension

members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.
  2. Install tiles with pattern running in one direction parallel to long axis of space.

3. Install tiles with pattern running in one direction parallel to short axis of space.
  4. Install tiles in a basket-weave pattern.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
  2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
  3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

#### 3.04 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 096513 – RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 20 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 THERMOPLASTIC-RUBBER BASE

- A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Group: I (solid, homogeneous) or II (layered).
  - 2. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring.
  - 1) Profile: As indicated
- B. Thickness: 0.125 inch
- C. Height: As indicated on Drawings.
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Job formed or preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: As selected by Architect from full range of industry colors.
- H. Basis of Design Product: Tarkett/ Johnsonite



## 2.2 VINYL BASE

- A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
  - 1. Group: I (solid, homogeneous) or II (layered).
  - 2. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring.
  - 1) Profile: As indicated
- B. Thickness: 0.125 inch
- C. Height: As indicated on Drawings.
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Job formed or preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: As selected by Architect from full range of industry colors.

## 2.3 RUBBER MOLDING ACCESSORY

- A. Description: Rubber reducer strip for resilient flooring, joiner for tile and carpet, transition strips
- B. Profile and Dimensions: As indicated
- C. Locations: Provide rubber molding accessories as required
- D. Colors and Patterns: As selected by Architect from full range of industry colors

## 2.4 VINYL MOLDING ACCESSORY

- A. Description: Vinyl reducer strip for resilient flooring, joiner for tile and carpet, transition strips
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide vinyl molding accessories as required
- D. Colors and Patterns: As selected by Architect from full range of industry colors

## 2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.
  2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

- b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6" in length.
    - a. Miter or cope corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  2. Tightly adhere to substrates throughout length of each piece.
  3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
  2. Sweep and vacuum horizontal surfaces thoroughly.
  3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
1. Apply one coat.
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

## SECTION 096514 – STAIR LANDINGS, RISERS, TREADS & RAMPS

### PART 1 – GENERAL INFORMATION

#### 1.01 SUMMARY

- A. This section deals with resilient flooring found in the drawings and schedules of the contract that meet the requirements of this section.

#### 1.02 RELATED SECTIONS

- A. Section 3 – Cement: not covered in this section.
- B. Section 6 – Wood and plastic: not covered in this section.
- C. Section 7 – Thermal and humidity protection: not covered in this section.
- D. Section 9 – Other sections containing information related to floor finishes: not covered in this section.

#### 1.03 REFERENCES (INDUSTRY STANDARDS)

- A. ASTM F 710: Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- B. ASTM E 648: Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM E 662: Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- D. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. ASTM F 2170: Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.

#### 1.04 ITEMS TO DELIVER

- A. Provide the product's Technical Specifications data sheet as well as all Installation and Maintenance Instructions.
- B. When required, supply floor drawings and installation plans.
- C. Supply a set of samples measuring at least 7.5 cm (3 in.) by 15 cm (6 in.) of the complete range of colors and finishes chosen for the project.
- D. When required, provide American Biltrite's attestation, certified by an independent laboratory, confirming that the flooring complies with the fire standards of the following tests:
  - 1. ASTM E 648; Critical Radiant Flux: 0.45 watts/cm<sup>2</sup> or more;
  - 2. ASTM E 662; Smoke Density: 450 or less.
- E. Provide American Biltrite's Warranty Certificate.

#### 1.05 QUALITY ASSURANCE

- A. Have American Biltrite flooring installed by a qualified installer of this type of flooring.
- B. In accordance with the technical instructions in the Installation Instructions, use all the accessories recommended by American Biltrite when installing its flooring.

- C. Follow the instructions specified in the most recent version of American Biltrite's Installation Instructions.

#### 1.06 DELIVERY, HANDLING, STORAGE

- A. Deliver the flooring to the installation site in American Biltrite's original packaging. Indicate the project name and handling instructions on the outside of the boxes.
- B. Advise the carrier of any damaged material and indicate it on the packing slip.
- C. Store the flooring inside, sheltered from extreme hot or cold temperatures. Place the material on a smooth level floor or where there is uniform solid support in a clean, dry well-ventilated area. Unstack the pallets. The long-term storage temperature must be maintained between 18°C (65°F) and 24°C (75°F). Protect adhesive and treads from freezing, extreme heat and direct sun exposure.
- D. Acclimatize the subfloor, all flooring material and adhesive for 48 hours before, during and after the installation by maintaining the room temperature between 18°C (65°F) and 24°C (75°F). The pallets should be unstacked 24 hours prior to use.
- E. Afterwards, maintain the room temperature between 18°C (65°F) and 29°C (85°F). Protect the material from direct sources of heat such as air vents and other types of heaters.
- F. Install the treads after all other finishing work, including painting, have been completed.

### PART 2 – PRODUCTS

#### 2.01 MANUFACTURER

- A. American Biltrite  
200 Bank Street  
Sherbrooke, QC, Canada, J1H 4K3  
Telephone: 819-829-3300  
Toll free: 1-800-437-8743  
Internet: [www.american-biltrite.com](http://www.american-biltrite.com)

#### 2.02 RESILIENT FLOORING AND STAIR TREADS

- A. One-Piece Stair Treads:
  - 1. ABPURE® One-piece Stair Treads with Riser (OPM) with Carborundum Strip
  - 2. Finish: Hammered
  - 3. Stair Tread Color: To be Selected by Architect from Manufacturer full range
  - 4. Carborundum Strip Color: To be Selected by Architect from Manufacturer full range
  - 5. Gauge: 317 mm
  - 6. One-piece: 0.914 m (36"), 1.219 m (48"), 1.828 m (72")
  - 7. Depth/Regular: 314.33 mm (12-3/8")
  - 8. Depth/One-Piece: 482.6 mm (19")
  - 9. Nosing Depth: 47.63 mm (1-7/8" ADA Compliant)
  - 10. Nosing Radius: 6 mm (1/4" ADA Compliant)
  - 11. Complies with ASTM F 2169 Type TS, class 2.
  - 12. Refer to the product's Technical Specifications data sheet for detailed specifications.

13. Choose from any of American Biltrite's complete line of colors (indicate the item number) for treads and detectable warning strips
14. ABPURE® has FloorScore certification.

B. Rubber Tile (Landings):

1. ABPURE® Tile
2. Finish: Slate Profile: ABF = Chips or ABA = No Chips
3. Gauge: 3 mm
4. Tile Size: 17 13/16" x 17 13/16" or 35 11/16" x 35 11/16"
5. Complies with ASTM F 1515 colorfastness test.
6. Refer to the product's Technical Specifications data sheet for detailed specifications.
7. Choose from any of American Biltrite's complete line of colors (indicate the item number)
8. ABPURE® has FloorScore certification.

2.03 ADHESIVES

- A. Use either American Biltrite's AD-777 or AD-535 adhesive. AD-777 and AD-535 both cover 18.6 sq. m/3.8 litres (200 sq. ft. /gallon) when applied with the recommended notched trowel.
- B. NC-888 epoxy nosing compound shall be applied along the inside of the tread nosing angle section AND where the tread and riser intersect. This will fill any voids in the steps.

2.04 OTHER MATERIAL

- A. Subfloor repairs: use a good-quality Portland cement-based compound modified with latex that has a minimal resistance to compression of 246 kg/cm<sup>2</sup> (3,500 lbs/sq. in.) to fill, smooth or level subfloor imperfections.
- B. Self-levelling underlayment: use a Portland cement-based self-levelling underlayment modified with a polymer that has a minimal resistance to compression of 246 kg/cm<sup>2</sup> (3,500 lbs/sq. in.).

PART 3 – EXECUTION

3.01 SITE INSPECTION

- A. Examine the subfloor before installation to ensure that the surface is clean, dry, smooth, structurally sound and free from foreign substances that may adversely affect adhesion or cause discoloration. Furthermore, ensure that the subfloor is free of paint, varnish, adhesive, oil, grease, solvent and other foreign substances, including treatment compounds, sealers and curing compounds that may adversely affect adhesion or alter the appearance or durability of the vinyl flooring.
- B. Verify the surface to ensure there is no powder, scaling or mold. If there is, remove it with a mechanical sander and level with a good-quality cement-based Portland primer.
- C. Slabs that have been either using a curing agent or a sealer will have to be treated to insure that the adhesion has not been impaired.
- D. Do not install on cement slabs that have been subjected to adhesive chemical abatement, unless an approved remediation system was used afterwards.

- E. Report and rectify all unsatisfactory conditions. Do not start flooring installation until all rectifications have been completed.

### 3.02 SUBFLOOR PREPARATION

- A. Level all rough surfaces and fill cracks and marks with a Portland cement-based patching compound modified with latex.
- B. Mechanically remove all surface contaminants such as paint, oil, grease, varnish, adhesive as well as various other products such as treatment compounds.
- C. Measure the humidity and pH levels in the cement in compliance with the following standards before installation:
  - 1. ASTM F 1869, Anhydrous Calcium Chloride test for Moisture levels. The maximum allowable reading is:
    - 5 lbs/1,000 sq. ft./24 hours (2.26 kg/92.9 sq. m/24 hours) for the AD-777 and AD-535 adhesives;
  - 2. ASTM F 2170, Relative Humidity (RH) test using in situ probes. The maximum allowable reading is 80% RH for AD-777 and 85%RH with AD-535 (to use in situation where RH goes up to 100% refer to the remediation document);
  - 3. ASTM F 710, pH levels (test procedure 5.3.1). The readings should be between 8 and 10;
  - 4. The ASTM test frequency recommendation is 3 measures for the first 1,000 sq. ft. (92.9 sq. m) and one measure for each additional 1,000 sq. ft. (92.9 sq. m).
- D. Ensure Moisture, Relative Humidity and pH tests have all been conducted and measurements meet manufacturer's recommendations.
- E. In case of doubt, test the adhesion on the cement subfloor or other surface that will be covered by the flooring. Do the test using the specified flooring and recommended adhesive.

### 3.03 RESILIENT FLOORING INSTALLATION

- A. Install the flooring according to the latest version of American Biltrite's Installation Instructions. Use the tools, adhesives, trowel types and procedures recommended in the instructions.
- B. Acclimatize the subfloor, all flooring material and adhesive for 48 hours before, during and after the installation by maintaining the room temperature between 18°C (65°F) and 24°C (75°F). Afterwards, maintain the temperature between 18°C (65°F) and 29°C (85°F).

### 3.04 CLEANING AND PROTECTION

- A. Remove all excess adhesive immediately after installation as recommended in American Biltrite's Installation Instructions.
- B. Before allowing traffic after installation, consult and follow the recommendations in American Biltrite's Installation Instructions.
- C. Follow the instructions in American Biltrite's Maintenance Instructions when performing initial and regular maintenance procedures.

END OF SECTION 096514



## SECTION 096519 – VINYL TILE FLOORING

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. SECTION INCLUDES:

1. Luxury Vinyl Tile (LVT) / Luxury Vinyl Plank (LVP)
2. Adhesives

##### B. RELATED SECTIONS

1. Section 03300 - Cast-In-Place Concrete Floor substrate requirements.
2. Section 06200 - Rough Carpentry: Floor substrate requirements.

#### 1.2 REFERENCES

##### A. American Concrete Institute (ACI):

1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

##### B. American Society for Testing and Materials (ASTM):

1. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
4. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
5. ASTM F137 - Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.
6. ASTM F141 - Standard Terminology Relating to Resilient Floor Coverings
7. ASTM F373 – Standard Test Method for Embossed Depth of Resilient Floor Covering
8. ASTM F386 – Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
9. ASTM F410 – Standard Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement
10. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

11. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
  12. ASTM F970 - Standard Test Method for Static Load Limit.
  13. ASTM F1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
  14. ASTM F1514 - Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change.
  15. ASTM F1515 – Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change
  16. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  17. ASTM F1914 - Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering.
  18. ASTM F2055 – Standard Test Method for Size and Squareness of Resilient Floor Tile
  19. ASTM F2199 - Standard Test Method for Determining Dimensional Stability of Resilient Floor Tile after Exposure to Heat.
  20. ASTM F2419 – Standard Practice for Installation of Thick Poured Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring.
  21. ASTM F2471 – Standard Practice for Installation of Thick Poured Lightweight Cellular Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring.
- C. State of California (CA)
1. CA Section 01350 – Special Environmental Requirements (Indoor Air Quality)
- D. California Department of Public Health (CDPH)
1. CDPH Standard Method v 1.2 - Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers
- E. California High Performance Schools (CHPS)
1. CHPS Section 01350 - Low-Emitting Materials Criteria for Use in Classrooms.
- F. Declare™
1. Product material disclosure labeling program.
- G. FloorScore®
1. Indoor Air Quality (IAQ) certification for flooring materials, adhesives and underlayments.
- H. Health Product Declaration Collaborative (HPDC)
1. Health Product Declaration (HPD) material disclosure list.

- I. International Standards Organization (ISO)
  - 1. ISO 9001 – Quality Management Systems (QMS)
  - 2. ISO 14001 – Environmental Management Systems (EMS)
  - 3. ISO 14025 – Environmental Labels and Declarations
- J. Living Building Challenge (LBC)
  - 1. LBC Chemical Red List Version 3.0.
- K. National Fire Protection Association (NFPA)
  - 1. NFPA 80 – Fire Safety Code.
  - 2. NFPA 253 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
  - 3. NFPA 255 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 4. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- L. Occupational Health and Safety Administration
  - 1. OHSAS 180001 – Occupational Health and Safety Management
- M. Resilient Floor Covering Institute (RFCI)
  - 1. Recommended Work Practices for Removal of Resilient Floor Coverings
- N. Underwriters Laboratories (UL) Environment
  - 1. Certified body of Environmental Product Declaration (EPD) and Environmental Management Systems (EMS), verified in accordance with ISO 9001, ISO 14001, ISO 14025 and OHSAS 18001.

### 1.3 SUBMITTALS

- A. General: Submittals must be submitted the under provisions of Section 01300.
- B. Product Data: Manufacturer's published documents on each product to be used, including:
  - 1. Storage and handling requirements.
  - 2. Installation instructions and initial maintenance instructions per Technical Data Sheets.
  - 3. Maintenance and initial finish application instructions per Care & Maintenance documents.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square or one full tile, representing actual product, color, and patterns.

#### 1.4 SUSTAINABILITY REQUIREMENTS

##### A. CA Section 01350 / CHPS Section 01350

1. Provide building materials that comply with CA Section 01350 and CHPS Section 01350 when tested in accordance with CDPH Standard Method v 1.2.
2. Provide test data or third party certification that confirms compliance, such as FloorScore certification.

##### B. Environmental Product Declaration

1. Provide EPDs that are independently verified by a qualifying body (such as UL) and compliant with ISO 14025.

##### C. Health Product Declaration

1. Provide HPDs that have been verified by the HPDC.

##### D. LBC Chemical Red List 3.1

1. Provide building materials that are Red List Free in accordance the LBC Chemical Red List 3.1.
2. Provide full material disclosure or third party certification that confirms compliance, such as Declare labeling.

#### 1.5 QUALITY ASSURANCE

##### A. Qualifications:

1. Installer Qualifications: Installer must be a professional, licensed and experienced installer. Installer must have familiarity with both the type, size and format of the product.
2. Manufacturer's Qualifications
  - a. Manufacturer must be ISO 9001, ISO 14001 and OHSAS 18001 compliant.
  - b. Manufacturer must provide remote and field technical support and service prior to, during and following installation, as necessary.

##### B. Mock-Up:

- a. Provide a mock-up for evaluation of product, surface preparation techniques and installation workmanship.
- b. Do not proceed with remaining work until size, color, thickness, sheen and workmanship are approved by Architect, End-User and/or other stakeholders.
- c. Maintain mock-up area as required in accordance with Care & Maintenance documents to produce acceptable work.

#### 1.6 DELIVERY HANDLING & STORAGE

- ##### A. Ordering: Comply with manufacturer's ordering and lead time requirements to avoid construction delays.

- B. Storage: Store products in climate controlled space (65° F (19° C) - 85° F (30° C) for at least 48 hours prior to installation. Keep products in manufacturer's unopened packaging until ready for installation (except for rolled goods).
- C. Acclimation: Rolled goods must be unrolled and allowed to relax and acclimate for 24 hours prior to installation.

## 1.7 PROJECT CONDITIONS

- 1. Environmental Conditions: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer in accordance with product technical data sheets. Do not install products under environmental conditions outside manufacturer's absolute limits.

## B. WARRANTY

- 1. Project Warranty: Refer to Conditions of Contract for project warranty provisions.
- 2. Manufacturer's Commercial Warranty:
  - a. 5mm AVA VRSE LVT shall be warranted for commercial use ten years for material or manufacture defects.

## PART 2 PRODUCTS

### 2.1 PRODUCT MANUFACTURERS

#### A. Acceptable Manufacturer:

- 1. AVA by Novalis Innovative Flooring  
Supplied by Lititz Flooring Company  
215 Bucky Drive  
Lititz, PA 17543  
P:800.492.2613  
E: sales@avaflor.com  
Web: www.avaflor.com

### 2.2 SUBSTITUTIONS

- A. Requests for substitutions will be considered in accordance with provisions of Division 01.

### 2.3 PRODUCT DIMENSIONS

- A. Product: AVA VRSE Luxury Vinyl Planks (LVP) as manufactured by Novalis Innovative Flooring.
- B. LVT Plank Sizes (all sizes nominal):

1. 9.84 inches by 39.37 inches by 3/16 inches (250.19 mm by 1 m by 5 mm)

## 2.4 PRODUCT COLOR

### A. Colors as selected by architect from manufacturers full range

1. Allegro
2. Andante
3. Ballad
4. Cantata
5. Chanson
6. Lyric
7. Melody
8. Minuet
9. Opera
10. Prelude
11. Rubato
12. Serenade
13. Tempo
14. Timbre
15. Treble
16. Vibrato

## 2.5 PHYSICAL CHARACTERISTICS

### A. ASTM F1700 – Solid Vinyl Tile:

1. Classification: Class III, Type B
2. ASTM F1914 – Residual Indentation: Passes, <10%
3. ASTM F137 – Flexibility: Passes
4. ASTM F2199 – Dimensional Stability: Passes, <0.05 in. change
5. ASTM F925 – Chemical Resistance:
  - a. White vinegar (5% Acetic Acid) - Passes.
  - b. Rubbing Alcohol (70% Isopropyl Alcohol) - Passes.
  - c. Lye (5% Sodium Hydroxide) - Passes.
  - d. Hydrochloric Acid (5% HCl) - Passes.
  - e. Sulfuric Acid (5% H<sub>2</sub>SO<sub>4</sub>) - Passes.
  - f. Household Ammonia (5% Ammonia) - Passes.
  - g. Disinfectant Cleaner (5% Active Phenol) - Passes.
  - h. Household Bleach (5.25% NaOCl) - Passes.
  - i. Unleaded Gasoline - Passes.
  - j. Kerosene - Passes.
  - k. Olive Oil - Passes.
6. ASTM F1514 – Color Heat Stability: Passes,  $\Delta E < 8$
7. ASTM F1515 – Color Light Stability: Passes,  $\Delta E < 8$
8. ASTM F970 – Static Load Limit: Passes, 250 lbs.
9. ASTM F970 – Modified for Max Weight: 1,200 lbs.

- B. ASTM E648 (NFPA 253) – Critical Radiant Flux: Class I, > 0.45 W/cm<sup>2</sup>
- C. ASTM E662 (NFPA 258) – Smoke Density: Passes, <450
- D. ASTM D2047 – Slip Resistance: >0.6 (dry)

## 2.6 PRODUCT ADHESIVE

- A. Only Novalis approved adhesives shall be used when installing VRSE.
  - 1. Novalis NFA T226 Acrylic Transitional Adhesive.
  - 2. Novalis NFA S300 Acrylic Aerosol Adhesive.
  - 3. Gold Series MW 3010 Modified Silane Resilient Flooring Adhesive.

## PART 3 EXECUTION

### 3.1 MANUFACTURERS INSTRUCTIONS

- A. Compliance: Review and comply with manufacturer's technical data sheets, care & maintenance documents, warranty information, technical bulletins and written specifications.

### 3.2 EXAMINATION

- A. Site Verification of Conditions:
  - 1. Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's technical data.
  - 2. Do not begin installation until all substrates have been properly tested and prepared in accordance with VRSE technical data sheets and applicable ASTM, ACI, NWFA and RFCI standards.
  - 3. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.3 PREPARATION

- A. Cleaning: Clean surfaces thoroughly prior to installation.
- B. Substrate Preparation: Prepare surfaces in accordance with substrate preparation requirements published in VRSE technical data sheets.

### 3.4 INSTALLATION

- A. Flooring Installation: Install materials in accordance with installation instructions published in AVA VRSE technical data sheets.
- B. Traffic Limits: No traffic, cleaning, finishing or placement of furniture should occur in accordance with adhesive traffic limits published in adhesive technical data.

- C. Initial Maintenance: Once adhesive has cured, perform initial maintenance in accordance with initial maintenance instructions published in VRSE technical data sheets and care & maintenance documents.

### 3.5 FINISH APPLICATION

- A. Initial Maintenance: Ensure surfaces have had initial maintenance performed in accordance with initial maintenance instructions published in VRSE technical data sheets and care & maintenance documents.
- B. Cleaning: Clean surfaces thoroughly prior to final use.

### 3.6 MAINTENANCE

- A. Daily Maintenance: Long-term care and maintenance must be performed in accordance with daily and routine maintenance instructions published in VRSE care & maintenance documents.

### 3.7 PROTECTION

- A. Temporary Floor Protection: Protect installed products until completion of project in accordance with flooring or material protection requirements published in VRSE technical data sheets and care & maintenance documents.
- B. Repair: Touch-up, repair or replace damaged products before Substantial Completion.
- C. Permanent Floor Protection: Ensure furniture feet/bottom, glides and chair casters dimensions and materials are in accordance with floor protection requirements published in AVA VRSE care & maintenance documents prior to Substantial Completion.

END OF SECTION 096519



## SECTION 096520 – RESILIENT SOLID VINYL TILE

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Resilient Solid Vinyl Tile
- B. Related Sections:

#### 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

#### 1.04 QUALITY ASSURANCE

- A. Mockups: Provide resilient products with mockups specified in other Sections.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

#### 1.06 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.

3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

## PART 2 - PRODUCTS

### 2.01 RESILIENT TILE FLOORING

- A. Manufacturer:  
Basis of Design: Tarkett, Inc.  
30000 Aurora Rd.  
Solon, Ohio 44139  
Web: [www.tarkettna.com](http://www.tarkettna.com)  
E-mail: [info@johnsonite.com](mailto:info@johnsonite.com)  
Phone: (800) 899-8916  
(440) 543-8916
- B. Or Architect Approved Equal
- C. Resilient Solid Vinyl Tile Flooring
- D. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite, a Tarkett Company; [Cortina Grande] [Cortina Grande SR].
- E. Sheet Standard: ASTM F 1700, [Class 1, Type A, Smooth surface] or [Class 1, Type B, Embossed surface].
- F. Thickness/Wearlayer: 0.125 inch
- G. For size specify: 16 inches by 16 inches
- H. Colors and Patterns: As selected by Architect from full range of industry colors. Refer to drawings for Patterns.
- I. Test data:
  1. Total thickness (ASTM F386): 0.080 inches (2 mm)
  2. Flexibility (ASTM F137): Passes
  3. Chemical Resistance (ASTM F925): Passes
  4. Static Load Limit (ASTM F 970): Passes 250 psi / Modified 800 psi
  5. Resistance to Heat (ASTM F1514):  $\Delta E \leq 8$
  6. Resistance to Light (ASTM F1515):  $\Delta E \leq 8$
  7. Residual Indentation (ASTM F1914): Passes
  8. Size, Tolerance (ASTM F2055): Passes
  9. Static Coefficient of Friction (ASTM D 2047):  $\geq 0.5$  SCOF
  10. Flamability (ASTM E648, Critical Radiant Flux): Class 1 ( $\geq 0.45$  W/cm<sup>2</sup>)
  11. Limited Commercial Warranty: 10 years

### 2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Portland Cementitious underlayment products.
- B. Adhesives: As recommended by Manufacturer to meet site conditions.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Prepare substrates according to manufacturer written instructions to ensure adhesion of Resilient Tile Flooring.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
  - 4. Prepare Substrates according to ASTM F 710 including the following:
    - a. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.
      - or –
      - 2) Perform relative humidity test using in situ probes, ASTM F 2170. Results must not exceed 80%.
    - b. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
    - c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
  - a. The floor must be rigid, free of movement.
  - b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
    - 1) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
    - 2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
  - c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayment's.
- B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Floor covering shall not be installed over expansion joints.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.03 RESILIENT TILE FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient tile flooring.
- B. Vinyl Enhanced Tile Flooring:
  1. Install with manufacturers standard adhesive specified for the site conditions and follow adhesive label for proper use.
  2. Follow manufacturers recommendation and lay tiles so graining follows the same direction.
  3. Roll the flooring in both directions using a 100 pound three-section roller.

### 3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  1. Remove adhesive and other blemishes from exposed surfaces.
  2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- E. Cover resilient products until Substantial Completion.
- F. Wait 72 hours after installation before performing initial cleaning.
- G. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 096520



## SECTION 096723 – RESINOUS FLOORING

### PART 1 – GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This section includes the following:
  - 1. Resinous flooring system as shown on the drawings and in schedules.
- B. Related sections include the following:
  - 1. Cast-in-Place Concrete, section 033000

#### 1.03 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with decorative chip broadcast and Epoxy broadcast and topcoats.
- B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 3/16 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- C. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted

#### 1.04 SUBMITTALS

- A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
- B. Manufacturer's Material Safety Data Sheet (MSDS) for each product being used.
- C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

#### 1.05 QUALITY ASSURANCE

- A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
- B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- C. No requests for substitutions shall be considered that would change the generic type of the specified System.
- D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.
- E. System shall be in compliance with the Indoor Air Quality requirements of California section 01350 as verified by a qualified independent testing laboratory.
- F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

## 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

### A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

### B. Storage and Protection

1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

### C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

## 1.07 PROJECT CONDITIONS

### A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

### B. Conditions of new concrete to be coated with cementitious urethane material.

1. Concrete shall be moisture cured for a minimum of 3 days and have fully cured a minimum of 5 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
3. Sealers and curing agents should not to be used.
4. Concrete shall have minimum design strength of 3,500 psi. and a maximum water/cement ratio of 0.45.
5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

### C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.



## 1.08 WARRANTY

- A. Manufacturer shall warrant that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Manufacturer published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
- B. Manufacturer liability with respect to this warranty is strictly limited to the value of the material purchase.

## PART 2 – PRODUCTS

### 2.01 FLOORING

- A. Basis of Design: Dur-A-Flex, Inc, Hybri-Flex EC (self-leveling chip broadcast), epoxy/aliphatic urethane topcoat seamless flooring system.
  - 1. System Materials:
    - a. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and SL aggregate.
    - b. The broadcast aggregate shall be Dur-A-Flex, Inc. Macro, Microchip or Earthstone Chip Blend.
    - c. Broadcast: Dur-A-Flex, Inc. Dur-A-Glaze #4, epoxy based two-component resin.
    - d. Seal coats: Dur-A-Flex, Inc Dur-A-Glaze #4, epoxy-based, two-component resin.
    - e. Top coat: Dur-A-Flex, Inc. Armor Top aliphatic urethane 2 component resin with grit.
  - 2. Finish - Orange Peel Finish
  - 3. Patch Materials
    - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).
    - b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Poly-Crete WR.

### 2.02 MANUFACTURER

- A. Basis of Design: Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
- B. Architect Approved Equal.

### 2.03 PRODUCT REQUIREMENTS

- |  |                              |
|--|------------------------------|
| A. Topping                                   | Poly-Crete SL                |
| 1. Percent Reactive                          | 100 %                        |
| 2. VOC                                       | 0 g/L                        |
| 3. Bond Strength to Concrete ASTM D 4541     | 400 psi, substrates fails    |
| 4. Compressive Strength, ASTM C 579          | 9,000 psi                    |
| 5. Tensile Strength, ASTM D 638              | 2,175 psi                    |
| 6. Flexural Strength, ASTM D 790             | 5,076 psi                    |
| 7. Impact Resistance @ 125 mils, MIL D-3134, | 160 inch lbs                 |
| No visible damage or deterioration           |                              |
| <br>B. Broadcast Coat                        | <br>Dur-A-Glaze #4 Resin     |
| 1. Percent Reactive,                         | 100 %                        |
| 2. VOC                                       | <4 g/L                       |
| 3. Water Absorption, ASTM D 570              | 0.04%                        |
| 4. Tensile Strength, ASTM D 638              | 4000psi                      |
| 5. Coefficient of thermal expansion          |                              |
| ASTM D 696,                                  | 2 x 10 <sup>-5</sup> in/in/F |
| 6. Flammability ASTM D-635                   | Self-Extinguishing           |
| 7. Flame Spread/ NFPA 101 ASTM E-84          | Class A                      |

C. Topcoat			Armor Top
1. VOC			0 g/L
2. 60 Degree Gloss ASTM D523			75+/-5
3. Mixed Viscosity, (Brookfield 25°C)			500 cps
4. Tensile strength, ASTM D 638			7,000 psi
5. Abrasion Resistance, ASTM D4060			Gloss Satin
CS 17 wheel (1,000 g load) 1,000 cycles	4	8	mg loss with grit
	10	12	mg loss without grit
6. Pot life @ 70° F 50% RH			2 hours
7. Dry properties, 70°F, 50% R.H.			8 hours tack free, 12 hours Dry
60°F, 30% RH			12 hours tack free, 18 hours Dry
80°F, 70%RH			4 hours tack free, 6 hours Dry
8. Flash Point PMCC			186°F
9. Full Chemical resistance			7 days

### PART 3 – EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
  1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

#### 3.02 PREPARATION

##### A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
  - a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.
  - b. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
  - c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
3. Mechanical surface preparation
  - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
  - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
  - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a

smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.

- d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

### 3.03 APPLICATION

#### A. General

1. The system shall be applied in five distinct steps as listed below:
  - a. Substrate preparation
  - b. Topping/overlay application with chip broadcast.
  - c. Resin application with chip broadcast.
  - d. Topcoat application
  - e. Second topcoat application.
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the applicator.

#### B. Topping

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Chip aggregate shall be broadcast to excess into the wet resin, Macro chip at the rate of 0.1 lbs/sf and Micro chip at the rate of 0.15 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

#### C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 100 sf/gal.
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. Chip aggregate shall be broadcast into the wet resin, Macro chips at the rate of 0.1 lbs/sf, Micro chips at the rate of 0.15 lbs/sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

D. Topcoat

1. The first topcoat shall be squeegee applied with a coverage rate of 100 sf/gal.
2. The topcoat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. The first topcoat will be back rolled and cross rolled to provide a uniform texture and finish
2. The second topcoat with grit shall be roller applied with a coverage rate of 500 sf/gal.
3. The finish floor will have a nominal thickness of 3/16 inch.

3.04 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
  - a. Temperature
    1. Air, substrate temperatures and, if applicable, dew point.
  - b. Coverage Rates
    1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.05 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 096723

## SECTION 096813 – CARPET TILE

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Division 01 Specification Sections

#### 1.2 SUMMARY

- A. This section relates to carpet tile.

#### 1.3 PREINSTALLATION MEETINGS

- A. Conducted at (insert time, location and key contact).

#### 1.4 SUBMITTALS

- A. Product Specification
- B. Specification for Adhesive
- C. Shop Drawings
- D. Samples
- E. Schedule
- F. Qualifications for Installer

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Instructions
- B. Warranty Documents

#### 1.6 QUALITY ASSURANCE

- A. Environmental:
  - 1. Green Label Plus Certified
  - 2. Cradle to Cradle Certified Gold
  - 3. NSF 140 Gold
  - 4. Health Product Declaration
  - 5. Declare Label, red list compliant

- 6. No PVC components
- B. Installer Qualifications: Installer who has been trained in the installation of carpet tile.
- C. Manufacturer Qualifications
  - 1. ISO 14001
  - 2. ISO 9001
  - 3. Reclamation Program: Will recycle EcoWorx carpet tile free of charge for quantities of 500 SY (418 SM) or more within continental United States and Canada or 5000 SY (4180 SM) globally.
- D. Mockups at designated location for architect review and approval.

#### 1.7 MATERIAL STORAGE AND HANDLING

- A. Store rolls on a flat surface, away from vents and direct sunlight.
- B. Store in protected dry conditions between 65 and 85 degrees.

#### 1.8 SITE CONDITIONS

The following conditions must be maintained for 24 hours prior to, during and permanently after installation:

- A. HVAC System must be operational.
- B. The installation site, carpet and adhesive must be between 50°F and 95°F.
- C. The installation site's ambient relative humidity must not fall below 40%.
- D. Conduct relative humidity or Anhydrous Calcium Chloride testing. Results must be within the proper range for Shaw 5000 adhesive:
  - 1. Calcium Chloride ASTM F-1869 5.0 lbs per 1000 SF /24 hours
  - 2. Relative Humidity ASTM F-2170 85%
  - 3. EcoLogix ES does not require moisture or pH testing.
- E. Conduct pH testing on the floor in several locations. A reading below 5.0 or above 9.0 requires corrective measures.

## PART 2 – PRODUCTS

### 2.1 TESTING REQUIREMENTS

- A. Pill Test CPSC FF 1 70: Pass
- B. Radiant Panel ASTM E648: Class I
- C. NBS smoke ASTM E662 NF: <450
- D. Static AATCC 134: <3.5 kv
- E. Coefficient of Friction: 0.6 (Meets ADA requirements)

### 2.2 TILE CARPETING

- A. Carpet to be selected from the Carpet types listed below.
- B. Final carpet selection may include a mixture of carpet types and colors for field and an accent between the listed carpets.
- C. Carpet colors will be selected from the product full range.
- D. Carpet field and accent layout to be finalized upon receipt of submittal and a layout drawing identifying colors will be provided by the architect.

### 2.3 TILE CARPETING – CARPET 1

- A. Manufacturer: Shaw Contract (Basis of Design)
- B. Product: Color Form tile
- C. Construction: Multi-level pattern loop
- D. Fiber: eco solution q nylon
- E. Dye Method: 100% solution dyed
- F. Backing: ecoworx tile
- G. Protective Treatment: ssp shaw soil protection
- H. Size: 9.0 x 36.0 inches
- I. Gauge: 3/12 inch
- J. Stitches: 10 per inch
- K. Finished Pile Thickness: 0.094 inches
- L. Average Density: 6511 per cu.yd.

- M. Total Thickness: 0.220 inches
- N. Tufted Weight: 17.0 oz/yd<sup>2</sup>
- O. Critical Radiant Flux shall be not less than 0.45 W/sq.cm.

#### 2.4 TILE CARPETING – CARPET 2

- A. Manufacturer: Shaw Contract (Basis of Design)
- B. Product: Diffuse 9x36 – 5T185
- C. Construction: Multi-Level Pattern Loop
- D. Fiber: Eco Solution Q Nylon
- E. Dye Method: 100% Solution Dyed
- F. Backing: EcoWorx Tile
- G. Protective Treatment: SSP Shaw Soil Protection
- H. Size: 9 in x 36 in
- I. Gauge: 1/12 in
- J. Stitches: 8.5 per in
- K. Finished Pile Thickness: 0.092 in
- L. Average Density: 6261 oz/yd<sup>3</sup>
- M. Total Thickness: 0.230 in
- N. Tufted Weight: 16 oz/yd<sup>2</sup>
- O. Critical Radiant Flux shall be not less than 0.45 W/sq.cm.

#### 2.5 TILE CARPETING – CARPET 3

- A. Manufacturer: Shaw Contract (Basis of Design)
- B. Product: Disperse 9x36 – 5T184
- C. Construction: Multi-Level Pattern Loop
- D. Fiber: Eco Solution Q Nylon
- E. Dye Method: 100% Solution Dyed
- F. Backing: EcoWorx Tile



- G. Protective Treatment: SSP Shaw Soil Protection
- H. Size: 9 in x 36 in
- I. Gauge: 1/12 in
- J. Stitches: 8.5 per in
- K. Finished Pile Thickness: 0.094 in
- L. Average Density: 6128 oz/yd<sup>3</sup>
- M. Total Thickness: 0.226 in
- N. Tufted Weight: 16 oz/yd<sup>2</sup>
- O. Critical Radiant Flux shall be not less than 0.45 W/sq.cm.

## 2.6 INSTALLATION MATERIALS

### A. Adhesives:

1. For EcoWorx (fiberglass reinforced):
  - a. Shaw 5000 pressure sensitive: 10 lbs. 95% RH pH 5-11
  - b. Shaw 5100 pressure sensitive: 8 lbs. 95% RH pH 5-11
  - c. Shaw 5036 with antimicrobial: 10 lbs. 95% RH pH 5-11
  - d. Shaw 3800 indoor/outdoor 8 lbs. 90% RH pH 5-9
  - e. LokDots dry adhesive: No visible moisture pH 12
  - f. LokWorx tabs: 10 lbs. 85 RH pH 12
  - g. Mill-applied ES: No visible moisture
2. For EcoLogix (attached cushion): All, excluding LokDots and LokWorx.
3. For StrataWorx (light weight tile alternative to broadloom)
  - a. Shaw 5000 pressure sensitive: 10 lbs. 95% RH pH 5-11
  - b. Shaw 5036 with antimicrobial: 10 lbs. 95% RH pH 5-11
  - c. Shaw 5100 pressure sensitive: 8 lbs. 95% RH pH 5-10

- B. Primer (if needed): 9050 is an acrylic solution made to neutralize excess alkali that is also recommend as a primer coat to prevent over absorption of adhesive and to ensure a better bond. Formulated with an antimicrobial agent, it provides protection against bacteria, fungi, and mildew in the wet or dry state. Contains no solvent, alcohol, or other hazardous materials per OSHA 29 CFR 1910.1200. Non-photo chemically reactive per rule #102. Available in 4-gallon pails.
- C. Leveling and Patching Compounds: Use a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.
- D. Transition Strips
- E. Cove Base Accessories:
  - 1. Angle Profile
  - 2. Detail Profile
  - 3. Quarter Round Profile



## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content, pH, smoothness and level.
- B. If dusting or powdering exists, seal the floor with a latex primer such as Shaw 9050.

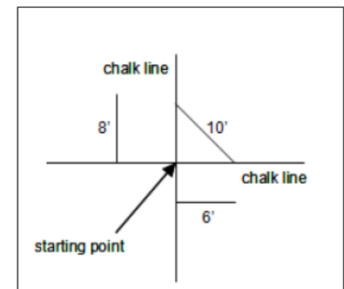
### 3.2 PREPARATION

- A. Substrates shall be smooth, structurally sound, permanently dry, clean and free of all foreign material such as dust, wax, solvents, paint, grease, oils, old adhesive residue, curing and hardening/ curing compounds, sealers and other foreign material that might prevent adhesive bond.
- B. Pre-existing Adhesive
  - 1. Non-Active Multipurpose Adhesive: Remove ridges, sweep or vacuum debris.
  - 2. Active Multipurpose Adhesive: Remove ridges then eliminate the adhesive tack with a product such as Shaw 6200.
  - 3. Pressure Sensitive Adhesive Affected by Plasticizer Migration: If the previous carpet tile had a PVC backing and the plasticizer in the backing has transferred to the adhesive, you must thoroughly remove adhesive by wet scrapping.

4. Existing Pressure Sensitive Adhesive: Evaluate the tack level of the existing adhesive. If sufficient, the existing adhesive can be used to install Shaw's tile products. If insufficient, apply new adhesive over existing adhesive.
  5. Active Cutback Adhesive: Wet scrape adhesive, reduce to a well-bonded residue and encapsulate with a product such as Shaw 9000.
  6. Non-active Cutback Adhesive: Wet scrape adhesive and reduce to a well-bonded residue.
- C. Fill depressions or cracks with a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.
- D. Flooring considerations:
1. Installing over VCT and VAT: Tiles must be secure to the subfloor. Strip any wax from the surface.
  2. Installing over wood subfloors: Prime with a liquid latex such as Shaw 9050.
  3. Installing over raised access flooring: Must be smooth, level, secure and clean. Install carpet tile at an offset from panel seams. Gaps must not exceed 1/16" (1.6 mm).

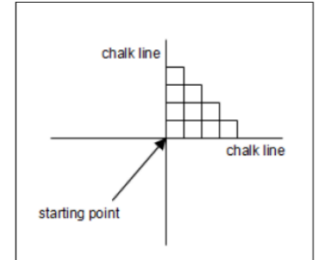
### 3.3 LAYOUT AND INSTALLATION

- A. Start the tile installation as near to the center of the room as possible and position it to use the largest perimeter cut tile size.
- B. Snap a chalk line parallel to one major wall bisecting the starting point. It may be necessary to offset the center chalk line to assure perimeter tiles will be at least half size.
- C. Snap a second chalk line from the starting point at 90° to the first line. Use a 3-4-5, 6-8-10, or larger triangle depending on the room size. Meters or feet may be used to lay out the triangle in these proportions.
- D. Use a full spread of adhesive applied with a 3/8" foam paint roller or 1/16 x 1/32 x 5/64 u-notch trowel. The adhesive must be allowed to dry completely before installing the carpet. Installing into wet adhesive will result into a permanent bond and may cause the carpet to bubble. Trowel application of adhesive is recommended for EcoLogix. EcoWorx ES / EcoLogix ES no adhesive required. Approximate coverage rates are 35-40 yards per gallon when applied with a roller, and 28 -33\* yards per gallon when applied with a trowel.
- E. Install each full carton and complete an entire pallet before starting another pallet to minimize product variation. Each tile has directional arrows on the back. These arrows allow for one-directional or multi-directional installation. Some styles may be large scale



or linear in design and require quarter turning. If you are unsure about whether or not your product requires a quarter turned installation, please contact 1.877.502.7429. Numbers within the arrows are for manufacturing purposes and are not related to installation.

- F. Begin installation at the intersection of two chalk lines. Continue until you complete one quadrant. Proceed to an adjoining quadrant until all four quadrants are completed. Larger areas may require chalk lines bisecting the original four quadrants.



- G. Install tiles using the pyramid technique. This gives you multiple alignment checks. If the edges do not align and the misalignment increases with progression of the installation, find and correct the source of the problem.
- H. Carpet tiles come in various sizes. All Shaw tiles have directional arrows on the back of the tile. Slide tiles into position to prevent yarn from being trapped between the tiles. Trapped yarn will adversely affect the appearance of the installation and will cause alignment problems.
- I. EcoWorx ES /EcoLogix ES are manufactured with the adhesive already applied. Once the tile is ready to install, simply peel the liner from the back and position snugly to the adjacent tile.
- J. Tiles must fit snugly, but not be compressed. Press the entire surface of the tile to ensure adhesion. Check for fit by measuring the length of ten full tiles after installation. The measurement must not be less than, or exceed by more than 1/4 inch, the length of the tiles being multiplied by ten. For example: if 24" X 24" tiles are being installed, the measurement should be between 240 and 240 1/4 inches.
- K. Measure and cut tiles from the back using a straight edge. Be sure the arrows are pointing in the correct direction.
- L. Roll the entire installation with a 75 lb. or greater roller to assure the proper adhesion to the substrate.

### 3.4 MAINTENANCE

- A. Post-installation Care
1. Place plywood over the carpet when heavy objects will be moved within 24 hours after installation.
- B. Preventative Floor Care
1. Use protective chair mats under chairs with casters.
  2. Use soil removal mats at exterior entrances.
  3. Use absorbent mats in areas where moisture, oil and grease are present.

C. Routine Maintenance

1. Set a schedule depending on traffic and vacuum regularly.
2. Remove spots with spot removers as soon as they occur.
3. Use encapsulation agents periodically.
4. Clean with hot water extraction periodically.

Traffic Level	Vacuum	Spot Removal	Interim Cleaning	Hot Water Extraction
Light	2/week	As needed	As needed	1/year
Moderate	1/day	As needed	As needed	1/year
Heavy	1/day	As needed	Monthly	4/year
Extra Heavy	1/day	As needed	Weekly	Monthly

END OF SECTION 096813



## SECTION 098439 – ACOUSTICAL CEILING CLOUDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Acoustical clouds
  - 2. Attachment hangers and fasteners
- B. Related Sections:
  - 1. Section 09 51 13 - Acoustical Ceilings
  - 2. Section 09 29 00 - Gypsum Board

#### 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - 2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 3. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- B. International Building Code

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of cloud system required.
- B. Installation Instructions: Submit manufacturer's installation instructions.
- C. Shop Drawings: Layout and details of acoustical clouds. Show locations of items which are to be coordinated with acoustical clouds.
- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

#### 1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical clouds and method of attachment by a single manufacturer.
- B. Coordination of Work: Coordinate acoustical cloud work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
- C. Seismic Performance: The International Building Code allows architectural components to swing freely as long as they will not be damaged or cause damage. Soundscapes Shapes Acoustical Clouds suspended individually with aircraft cable will swing no more than 18 inches in any direction for each panel. Shapes direct attached to drywall or suspended in group systems have been engineered for application in all seismic areas.
- D. Acoustical acoustical clouds, as with other architectural features located in the ceiling plane, may obstruct or skew the existing or planned fire sprinkler water distribution pattern, or possibly delay the activation of the fire sprinkler or fire detection system. Designers and installers are advised to consult a fire protection engineer, NFPA 13, and their local codes for guidance on the proper installation techniques where fire detection or suppression systems are present.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical clouds to project site in original, unopened packages and store them in a fully enclosed space between 40°F (4° C) and 120°F (49° C) where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes. All wet work (plastering, concrete, etc) must be complete and dry.
- B. Before installing acoustical clouds, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical clouds carefully to avoid damaging the surface and edges in any way.

#### 1.7 PROJECT CONDITIONS

- A. Space Enclosure:  
Building areas to receive acoustical clouds shall be free of construction dust and debris. Products can be installed in temperatures between 40°F (4° C) and 120°F (49° C). Cannot be used in exterior applications, where standing water is present, or where moisture will come in direct contact with the acoustical cloud.

#### 1.8 WARRANTY

- A. Acoustical Clouds: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical clouds that fail within the warranty period. Failures include, but are not limited to:
  - 1. Acoustical clouds: Manufacturing defects.
  - 2. Attachment devices: Rusting and manufacturing defects.
- B. Warranty Period:
  - 1. Acoustical Clouds: One (1) year from date of substantial completion.
  - 2. Attachment devices: One (1) year from date of substantial completion.



- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acoustical Clouds:
1. Armstrong World Industries, Inc.
- B. Attachment devices:
1. Armstrong World Industries, Inc.

### 2.2. ACOUSTICAL CLOUD UNITS

- A. Acoustical Cloud:
1. Surface Texture: Smooth
  2. Composition: Fiberglass
  3. Surface finish: DuraBrite acoustically transparent membrane on front and edges
  4. Color: As selected by Architect from Manufacturers standard colors
  5. Shapes:
    - a. Nominal 4 foot x 4 foot Shapes
      1. Circle, Item #5443
    - b. Canopies 46 1/2" x 75" x 1-1/4"
      1. Hill Canopy, Item #6258
      2. Valley Canopy, Item #6259
  6. Thickness: 7/8 inch
  7. Edge Detail: Square edge
  8. Flame Spread: (ASTM E 84), Class A
  9. Light Reflectance: (LR): (ASTM E 1477), White: 0.90
  10. Acoustical Absorption: (ASTM C423), [White: Minimum 1.17 Sabins/sf] [Colors: Minimum 1.00 Sabins/sf]
  11. Recycle Content: Minimum 35%
  12. Antimicrobial protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

13. Sustainability: The panels are eligible for reclamation.

## 2.3 ATTACHMENT SYSTEMS

- A. Installation Hardware Kits for (individual suspension) (direct attachment to drywall) (group suspension):
  1. 5450 – Deck Hanging Kit
  2. 5451 – Grouping Frames
  3. 5452 – Frame Splice Kit
  4. 5453 – Frame Alignment Kit
  5. 5454 – Panel Hook Kit
  6. 5455 – Drywall Hanging Kit
  7. 625530 – Extended Hanging Cables
  8. 7006 – Escutcheon Kit

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical clouds and installation hardware. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

### 3.2 INSTALLATION

- A. Install panels in accordance with the manufacturer's instructions, LA-297302, and in compliance with the authorities having jurisdiction.

### 3.3 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical clouds per manufacturer's instructions.

END OF SECTION 098439

## SECTION 099113 – EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES: (See Paint Schedule and finish designations)

- A. Painting interior
- B. Natural finish of wood

#### 1.02 RELATED SECTIONS: (including but not limited to)

- A. Section 03300, Cast-In-Place Concrete
- B. Section 04200, Unit Masonry
- C. Section 05120, Structural Steel
- D. Section 05505, Miscellaneous Structural Fabrication
- E. Section 09260, Gypsum Board Assemblies

#### 1.03 DEFINITIONS

- A. "Paint or Painting" as used in this specification, are in a general sense and include: Sealers, primers, stains; oil, alkyd, latex, epoxy, and enamel type paints; lacquers; fillers; and the application of these materials.

#### 1.04 PRODUCT SUBMITTALS

- A. Product Data: Listing of proposed products matched to specified products. Cut sheet for each product indicating generic formulation, sheen, ingredients, percentage by volume, and breakdown of pigment versus vehicle.
- B. Samples: Full range of custom mixed color chips for selection.

#### 1.05 CONTRACT CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

#### 1.06 PACKING AND DELIVERY

- A. Delivery: Unopened containers with manufacturer's labels indicating type of paint, stock number, color number and instructions.

## 1.07 STORAGE AND PROTECTION

- A. Storage: Do not store volatiles, thinners, and solvents (including rags and tool cleaning pails) within the building.

## 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Temperature:
  - 1. Interior: Constant 65 degrees F. or above. Prevent wide variations in temperature which might result in condensation.
  - 2. Exterior: Do not paint materials when temperature is below 50 degrees F.
- B. Avoid painting any surfaces while they are exposed to hot sun.
- C. Provide proper conditions of ventilation and light; use artificial light in quantity equivalent to normal occupancy lighting.

## PART 2 - PRODUCTS

### 2.01 PAINT AND FINISHES

- A. Manufacturer:
  - 1. Pratt & Lambert, Inc.
  - 2. PPG Industries
  - 3. M.A. Bruder & Sons, Inc.
  - 4. Sherwin Williams (Product #s specified)
  - 5. ICI Glidden
  - 6. Benjamin Moore Paint Co.
  - 7. Duron Paints & Wallcoverings
- B. Specific products are indicated in painting schedule included at the end of this Section. These products establish a standard of quality. Others may be required to substantiate properties and qualities.
- C. Ready-mixed; well ground, not settle badly, cake or thicken in the container, readily broken up with a paddle to a smooth consistency; and having easy brushing properties; Lead free.
- D. Colors: Standard colors.
  - 1. Eight (8) eggshell colors for walls throughout.
  - 2. Four (4) semi-gloss colors for closet shelving.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Inspection and Surfaces:

1. Carefully examine executed work of other trades which might affect this Work.
  2. Commencement of priming of surfaces constitutes acceptance by Contractor that surface meets finish and manufacturers requirements.
- B. Protect materials and equipment from damage by painting and finishing.
1. Tape, mask, cover and/or coat adjacent materials, areas, surfaces, and equipment not to receive finishes noted in this Section. Specifically protect wood floors and natural unfinished wood.
  2. Before painting, remove hardware, accessories, plates and similar items or provide ample protection of such items.
  3. Remove doors, if necessary, to paint bottom edge.
  4. Use only skilled mechanics for removing and replacing such items. Upon completion of each space replace above items.
- C. General Preparation of Surfaces:
1. Prepare all surfaces in accordance with manufacturer's recommendations for product being used.
  2. Surfaces: Clean; dry; free of moisture and dampness; smooth, even, true to plane; and free of material which will adversely affect adhesion or appearance of applied coating.

### 3.02 PREPARATION- WOOD SURFACES TO BE PAINTED OR FINISHED

- A. Dry, clean, and free from oil, grease, wax, loose dirt or other foreign matter.
- B. Sand surfaces smooth and even, and then dust off before applying the first coat.
- C. Coat knots, sap streaks, and pitch spots with recommended sealer.
- D. Fill nail holes, cracks, and imperfections.
1. Paint Finish: Use wood putty
  2. Natural or Stain Finish: Use plastic wood filler (match for species and finish color).
- E. Apply paste wood filler on open grain wood. Wipe across the grain; then with a circular motion to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface until smooth.

### 3.03 PREPARATION- METAL SURFACES TO BE PAINTED

- A. Thoroughly clean metal surfaces where rust or scale is present, by the use of wire brushing and/or abrasive paper.
- B. Wash surfaces with mineral spirits to remove any grease, oil or dirt.
- C. Touch-up all shop primed or coated surfaces chipped or abraded, using shop coat material specified. Feather edges of damaged shop coat to achieve smooth finish. Comply with metal preparation as indicated by the manufacturer of the coating.

### 3.04 PREPARATION- MASONRY SURFACES

- A. Masonry Surfaces: Allow to cure at least thirty (30) days before painting. Before apply the first coat of paint, fill all joints and point up all holes, Correct any imperfections. Remove all mortar or plaster droppings and any other foreign matter. Brush surfaces with a stiff bristle or wire brush.
- B. Neutralize free lime with a solution acceptable to the manufacturers of the paint which is to be applied.

### 3.05 PREPARATION- CONCRETE SURFACES

- A. Patch openings, voids, holes, cracks, and irregularities with Portland Cement mortar and finish flush with adjacent surfaces.
- B. Remove contaminants, oil, scum, grease, and the like.
- C. Remove all loose, powdery or dusting surface laitance mechanically (scarification).
- D. Remove form oil from concrete as recommended by paint manufacturer for proper adhesion.
- E. Allow surfaces to dry completely, usually 60 to 90 days of moderate, weather, before painting.

### 3.06 PREPARATION- GYPSUM BOARD SURFACES

- A. Fill all minor irregularities with spackling compound and sand to smooth, level surfaces. Exercise care to avoid raising nap of paper.
- B. Allow to cure at least 15 days before painting.
- C. Do not use sandpaper on paper surfaces to be painted.
- D. Do not apply paint or sealer when moisture content exceeds that required by paint manufacturer.

### 3.07 APPLICATION OF PAINTS

- A. General Requirements: Comply with manufacturer's instructions including environmental conditions, temperatures, pot life, drying and recoating times. Utilize tools and equipment recommended for products.
  - 1. Do not apply coating until moisture content of surface is within limitations recommended by the paint manufacturer. Test with moisture meter. Submit results to Architect at close of each day.
  - 2. Apply paint, enamel, stains and varnishes with suitable brushes, rollers or spray equipment which have been kept clean, free from contamination and suitable for finish required.
  - 3. Rate of application of coating shall not exceed that as recommended by the paint manufacturer for the purpose of surface involved.
  - 4. Sand and dust between each coat to remove visible defects and blemishes.

B. Coverage:

1. Apply not less than 2 separate and distinct coats of finish on all exposed Work throughout.
2. Apply to shop or factory primed surfaces not less than 1 finish coat; in addition to the prime coat.
3. Apply additional coats should there be a deficiency in coverage.
4. Apply additional coats over entire surface until paint film is of uniform finish, color appearance and coverage, specifically when previous color, stain, dirt, spackle, patching or undercoats show through final coats.
5. If problems arise in connection with application of paint, stop painting area immediately and contact paint manufacturer for recommendation.

C. Methods of Application:

1. Brush Application: Brush each coat out uniformly to eliminate laps, skips and excess brush marks. Brush apply field coats on metals, and trim.
2. Roller Application: Use proper skill to avoid signs of lapping and excess paint lines from edge of roller. When cutting in with a brush is required, these areas must be of same texture, color and hiding as adjacent areas, to ensure good appearance.
3. Spray Application: Absolute masking and protective measures shall be taken to avoid damage to other finish materials. Manufacturer's recommendations for dry mil thickness are minimums and square feet per gallon shall not be exceeded. Paints shall not be diluted for purpose of spraying.

D. Drying:

1. Do not apply any type finish until the preceding coats are thoroughly dry and hard.
2. Interior Paint: Allow to dry at least 24 hours between coats.
3. Exterior Paint: Allow to dry at least 48 hours between coats.

E. Appearance: (As visible from 3 feet)

1. Smooth and even; free from runs, sags, skips, streaks and holidays.
2. No variation in sheen or color within continuous surfaces.
3. No clogging of lines and angles of shapes and details.
4. Edges (adjoining other materials or other colors): Paint sharp and clean without overlapping.
5. Coats: Proper consistency and well spread so as to show no laps and brush marks.

### 3.08 REPAIR AND CORRECTION

- A. Repair damage (resulting from painting) done to the Work of others and existing Work.
- B. Correct Work damage caused by drafty, dusty conditions or cold, to complete satisfaction, without additional cost.
- C. Refinish entire surface where portion of finish has been damaged or is not acceptable.

- D. No claims will be allowed for correction of defective Work caused by failure to adequately prepare substrates and abide by manufacturers recommendations.

### 3.09 CLEANING

- A. Touch-up and restore where finish is damaged.
- B. Remove spilled, splashed or splattered paint from all surfaces.
- C. Do not mar surface finish of item being cleaned.
- D. Leave storage spaces clean and in condition required for equivalent spaces in project. Leave premises clean and free from all rubbish and accumulated material left from this Work.

### 3.10 SCHEDULE - EXTERIOR SURFACES (NORMAL EXPOSURE)

#### A. MASONRY - (Walls & Ceilings, Concrete, Cement Board)

##### 1. Latex Systems:

##### a. Semi-Gloss Finish:

1st Coat: S-W Loxon Concrete & Masonry Primer LX02 Series (2.1 mils wet, 3.2 mils dry)  
2nd Coat: S-W Resilience Exterior K43 Series  
3rd Coat: S-W Resilience Exterior K43 Series (4.0 mils wet, 1.6 mils dry per coat.)

#### B. MASONRY - (CMU - Concrete or Concrete Masonry Units)

##### 1. Latex Systems:

##### a. Semi-Gloss Finish:

1st Coat: S-W Loxon Block Surfacers LX01 Series (16.0 mils wet, 8.8 dry)  
2nd Coat: S-W Resilience Exterior K43 Series  
3rd Coat: S-W Resilience Exterior K43 Series (4 mils wet, 1.6 mils dry per coat.)

##### b. Flat Finish:

1st Coat: S-W W Loxon Block Surfacers LX01 Series (16.0 mils wet, 8.8 dry)  
2nd Coat: S-W Resilience Exterior K42 Series  
3rd Coat: S-W Resilience Exterior K42 Series (4.0 mils wet, 1.6 dry)

#### C. CONCRETE - (Floors)

##### 1. Epoxy System:

##### a. Gloss Finish:

1st Coat: ArmorSeal 1000HS B67-2000 Series (reduced 1 pt/gal with R7K54)



2nd Coat: S-W ArmorSeal 1000HS B67-2000 Series  
3<sup>rd</sup> Coat: S-W ArmorSeal 1000HS B67-2000 Series  
(5-8 mils wet, 3-5 mils dry per coat) Add anti-slip aggregate  
if required.

D. METAL - (Aluminum)

1. Latex Systems:

a. Semi-Gloss Finish:

1<sup>st</sup> Coat: Pro Industrial Pro-Cryl Universal Primer B66-310 Series  
@ 2.0-4.0 mils dry  
2<sup>nd</sup> Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
3<sup>rd</sup> Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
(4-12 mils wet, 2.5-4 mils dry per coat)

E. METAL - (Galvanized)

1. Latex Systems:

a. Semi-Gloss Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro-Cryl Universal Primer B66-310  
Series @ 2.0-4.0 mils dry  
2<sup>nd</sup> Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
3<sup>rd</sup> Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

b. Eg-Shel Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro-Cryl Universal Primer B66-310  
Series @ 2.0-4.0 mils dry  
2<sup>nd</sup> Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series  
3<sup>rd</sup> Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

Note: This finish product is self-priming on aluminum and galvanized surfaces. If  
primer is desired use:

F. METAL - Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental  
Iron, Sashes, Doors, Partitions, Cabinets, Lockers, Fixtures, Equipment, Copper, Non-  
Galvanized Metal

1. Latex Systems:

a. Gloss Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro-Cryl Universal Primer B66-310  
Series  
(5-10 mils wet, -4 mils dry)  
2<sup>nd</sup> Coat: S-W Pro Industrial Acrylic Gloss B66-610 Series  
3<sup>rd</sup> Coat: S-W Pro Industrial Acrylic Gloss B66-610 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

b. Semi-Gloss Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro-Cryl Universal Primer B66-310  
Series (5-10 mils wet, 2-4 mils dry)  
2<sup>nd</sup> Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series

3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

c. Eg-Shel Finish:

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer B66-310 Series

(5-10 mils wet, 2-4 mils dry)

2nd Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series

3rd Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

G. WOOD - Walls, Ceilings, Doors, Trim, Cabinet Work, Counters, Partitions, Frames  
Including Sitka Spruce, Southern Pine, Douglas Fir, Cedar, Redwood, Lauan)

1. Latex Systems:

a. Gloss Finish:

1st Coat: S-W Premium Wall & Wood Primer, B28W08111  
(4 mils wet, 1.8 mils dry)

2nd Coat: Pro Industrial Acrylic Gloss B66-610 Series

3rd Coat: Pro Industrial Acrylic Gloss B66-610 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

b. Semi-Gloss Finish:

1st Coat: Premium Wall & Wood Primer, B28W08111  
(4 mils wet, 1.8 mils dry)

2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series

3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss B66-650 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

c. Eg-Shell Finish:

1st Coat: Premium Wall & Wood Primer, B28W08111  
(4 mils wet, 1.8 mils dry)

2nd Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series

3rd Coat: S-W Pro Industrial Acrylic Eg-Shel B66-660 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

2. Stained & Varnished (Clear Finish)

a. Open Grained Wood:

1st Coat: S-W Woodscapes Exterior Polyurethane  
Semi Transparent Stain A15 Series

2nd Coat: S-W SHERWOOD Natural Filler, D7OTI<  
Delete – No longer used.

b. Closed Grain Wood:

1st Coat: S-W Woodscapes Exterior Stain A15 Series

2nd Coat: S-W Wood Classics Waterborne  
Polyurethane Varnish Gloss A67 Series

3rd Coat: S-W Wood Classics Waterborne Polyurethane Varnish  
Gloss or Satin A67 Series (4 mils wet, 1.7 mils dry per coat)

H. DRYWALL - (Walls, Ceilings, Gypsum Board, Etc.)

1. Latex Systems:

a. Gloss Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Primer (4 mils wet, 1.0 mils dry)

2nd Coat: Pro Industrial Acrylic Gloss B66-610 Series

3rd Coat: Pro Industrial Acrylic Gloss B66-610 Series  
(6-12 mils wet, 2.5-4 mils dry per coat)

b. Semi-Gloss Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Primer  
(4 mils wet, 1.0 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B30-2600 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B30-2600 Series (4 mils wet, 1.6 mils dry per coat.)

c. Eg-Shell Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Primer  
(4 mils wet, 1.0 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel B20-2600 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel B20-2600 Series (4 mils wet, 1.7 mils dry per coat)

d. Flat Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Primer  
(4 mils wet, 1.0 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall B3OW2600 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall B3OW2600 Series (4 mils wet, 1.6 mils dry)

END OF SECTION 099113



## SECTION 099123 – INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES: (See Paint Schedule and finish designations)

- A. Interior painting where required at disturbed finishes, to match existing.

#### 1.02 DEFINITIONS

- A. "Paint or Painting" as used in this specification, are in a general sense and include: Sealers, primers, stains; oil, alkyd, latex, epoxy, and enamel type paints; lacquers; fillers; and the application of these materials.

#### 1.03 PRODUCT SUBMITTALS

- A. Product Data: Listing of proposed products matched to specified products. Cut sheet for each product indicating generic formulation, sheen, ingredients, percentage by volume, and breakdown of pigment versus vehicle.
- B. Samples: Full range of custom mixed color chips for selection.

#### 1.04 CONTRACT CLOSEOUT SUBMITTALS

- A. Maintenance Materials: Turn over to Owner upon completion; one gallon of each type and color of finish. Include color pigmentation formulation.

#### 1.05 PACKING AND DELIVERY

- A. Delivery: Unopened containers with manufacturer's labels indicating type of paint, stock number, color number and instructions.

#### 1.06 STORAGE AND PROTECTION

- A. Storage: Do not store volatiles, thinners, and solvents (including rags and tool cleaning pails) within the building.

#### 1.07 ENVIRONMENTAL REQUIREMENTS

- A. Temperature:
  - 1. Interior: Constant 65 degrees F. or above. Prevent wide variations in temperature which might result in condensation.
- B. Avoid painting any surfaces while they are exposed to hot sun.
- C. Provide proper conditions of ventilation and light; use artificial light in quantity equivalent to normal occupancy lighting.

### PART 2 - PRODUCTS

## 2.01 PAINT AND FINISHES

- A. Manufacturer:  
Benjamin Moore Paint Co. (Product #s specified on Drawings)  
Sherwin Williams (Product #s specified in Specification)  
Pratt & Lambert, Inc.  
ICI Glidden  
M.A. Bruder & Sons, Inc.  
Duron Paints & Wallcoverings  
PPG Industries
- B. Specific products are indicated in painting schedule included at the end of this Section. These products establish a standard of quality. Others may be required to substantiate properties and qualities.
- C. Ready-mixed; well ground, not settle badly, cake or thicken in the container, readily broken up with a paddle to a smooth consistency; and having easy brushing properties; Lead free.
- D. Colors: Standard colors.
  - 1. Refer to Pain Schedule or Colors selected by owner following bid

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Inspection and Surfaces:
  - 1. Carefully examine executed work of other trades which might affect this work.
- B. Protect materials and equipment from damage by painting and finishing.
  - 1. Tape, mask, cover and/or coat adjacent materials, areas, surfaces, and equipment not to receive finishes noted in this Section. Specifically protect wood floors and natural unfinished wood.
  - 2. Before painting, remove hardware, accessories, plates and similar items or provide ample protection of such items.
  - 3. Remove doors, if necessary, to paint bottom edge.
  - 4. Use only skilled mechanics for removing and replacing such items. Upon completion of each space, replace above items.
- C. General Preparation of Surfaces:
  - 1. Prepare all surfaces in accordance with manufacturer's recommendations for product being used.
  - 2. Surfaces: Clean; dry; free of moisture and dampness; smooth, even, true to plane; and free of material which will adversely affect adhesion or appearance of applied coating.

### 3.02 PREPARATION- WOOD SURFACES TO BE PAINTED OR FINISHED

- A. Dry, clean, and free from oil, grease, wax, loose dirt or other foreign matter.

- B. Sand surfaces smooth and even, and then dust off before applying the first coat.
- C. Coat knots, sap streaks, and pitch spots with recommended sealer.
- D. Fill nail holes, cracks, and imperfections.
  - 1. Paint Finish: Use wood putty.
  - 2. Natural or Stain Finish: Use plastic wood filler (match for specie and finish color).
- E. Apply paste wood filler on open grain wood. Wipe across the grain; then with a circular motion to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface until smooth.

### 3.03 PREPARATION- METAL SURFACES TO BE PAINTED

- A. Thoroughly clean metal surfaces where rust or scale is present, by the use of wire brushing and/or abrasive paper.
- B. Wash surfaces with mineral spirits to remove any grease, oil or dirt.
- C. Touch-up all shop primed or coated surfaces chipped or abraded, using shop coat material specified. Feather edges of damaged shop coat to achieve smooth finish. Comply with metal preparation as indicated by the manufacturer of the coating.

### 3.04 PREPARATION- MASONRY SURFACES

- A. Masonry Surfaces: Allow to cure at least thirty (30) days before painting. Before apply the first coat of paint, fill all joints and point up all holes, Correct any imperfections. Remove all mortar or plaster droppings and any other foreign matter. Brush surfaces with a stiff bristle or wire brush.
- B. Neutralize free lime with a solution acceptable to the manufacturers of the paint which is to be applied.

### 3.05 PREPARATION - CONCRETE SURFACES

- A. Patch openings, voids, holes, cracks, and irregularities with Portland Cement mortar and finish flush with adjacent surfaces.
- B. Remove contaminants, oil, scum, grease, and the like.
- C. Remove all loose, powdery or dusting surface laitance mechanically (scarification).
- D. Remove form oil from concrete as recommended by paint manufacturer for proper adhesion.
- E. Allow surfaces to dry completely, usually 60 to 90 days of moderate, weather, before painting.

### 3.06 PREPARATION- GYPSUM BOARD SURFACES

- A. Fill all minor irregularities with spackling compound and sand to smooth, level surfaces. Exercise care to avoid raising nap of paper.
- B. Allow to cure at least 15 days before painting.

- C. Do not use sandpaper on paper surfaces to be painted.
- D. Do not apply paint or sealer when moisture content exceeds that required by paint manufacturer.

### 3.07 PREPARATION – TECTUM PANELS

- A. Surface must be clean, dry and in sound condition.
- B. Remove all oil, dirt, grease and other foreign material to ensure adequate adhesion.

### 3.08 APPLICATION OF PAINTS

- A. General Requirements: Comply with manufacturer's instructions including environmental conditions, temperatures, pot life, drying and recoating times. Utilize tools and equipment recommended for products.

1. Do not apply coating until moisture content of surface is within limitations recommended by the paint manufacturer. Test with moisture meter.
2. Apply paint, enamel, stains and varnishes with suitable brushes, rollers or spray equipment which have been kept clean, free from contamination and suitable for finish required.
3. Rate of application of coating shall not exceed that as recommended by the paint manufacturer for the purpose of surface involved.
4. Sand and dust between each coat to remove visible defects and blemishes.

- B. Coverage:

1. Apply not less than 2 separate and distinct coats of finish on all exposed Work throughout.
2. Apply to shop or factory primed surfaces not less than 1 finish coat; in addition to the prime coat.
3. Apply additional coats should there be a deficiency in coverage.
4. Apply additional coats over entire surface until paint film is of uniform finish, color appearance and coverage, specifically when previous color, stain, dirt, spackle, patching or undercoats show through final coats.
5. If problems arise in connection with application of paint, stop painting area immediately and contact paint manufacturer for recommendation.

- C. Methods of Application:

1. Brush Application: Brush each coat out uniformly to eliminate laps, skips and excess brush marks. Brush apply field coats on metals, and trim.
2. Roller Application: Use proper skill to avoid signs of lapping and excess paint lines from edge of roller. When cutting in with a brush is required, these areas must be of same texture, color and hiding as adjacent areas, to ensure good appearance.



3. Spray Application: Absolute masking and protective measures shall be taken to avoid damage to other finish materials. Manufacturer's recommendations for dry mil thickness are minimums and square feet per gallon shall not be exceeded. Paints shall not be diluted for purpose of spraying.

D. Drying:

1. Do not apply any type finish until the preceding coats are thoroughly dry and hard.
2. Interior Paint: Allow to dry at least 24 hours between coats.
3. Exterior Paint: Allow to dry at least 48 hours between coats.

E. Appearance: (As visible from 3 feet)

1. Smooth and even; free from runs, sags, skips, streaks and holidays.
2. No variation in sheen or color within continuous surfaces.
3. No clogging of lines and angles of shapes and details.
4. Edges (adjoining other materials or other colors): Paint sharp and clean without overlapping.
5. Coats: Proper consistency and well spread so as to show no laps and brush marks.

3.09 REPAIR AND CORRECTION

- A. Repair damage (resulting from painting) done to the Work of others and existing Work.
- B. Correct Work damage caused by drafty, dusty conditions or cold, to complete satisfaction, without additional cost.
- C. Refinish entire surface where portion of finish has been damaged or is not acceptable.
- D. No claims will be allowed for correction of defective Work caused by failure to adequately prepare substrates and abide by manufacturers recommendations.

3.10 CLEANING

- A. Touch-up and restore where finish is damaged.
- B. Remove spilled, splashed or splattered paint from all surfaces.
- C. Do not mar surface finish of item being cleaned.
- D. Leave storage spaces clean and in condition required for equivalent spaces in project. Leave premises clean and free from all rubbish and accumulated material left from this Work.

PART 4 - SCHEDULE - INTERIOR SURFACES (NORMAL EXPOSURE)

4.01 SCHEDULE

A. MASONRY - (Walls & Ceilings, Concrete, Cement Board)

1. Latex Systems:
  - a. Semi-Gloss Finish:

1st Coat: S-W Loxon Concrete & Masonry Primer A24W08300 (5.3 wet, 2.1 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss Enamel, B31W02651  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss Enamel, B31W02651  
(4 mils wet, 1.5 mils dry per coat)

B. MASONRY - (CMU - Concrete or Cinder Block)

1. Latex Systems:

a. Semi-Gloss Finish:

1st Coat: S-W ProMar Interior/Exterior Block Filler B25W00035  
(75-125 sq.ft./gal.)  
2nd Coat: S-W ProMar Zero VOC 200 Latex Semi-Gloss B31W02651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
(4 mils wet, 1.5 mils dry per coat)

b. Flat Finish:

1st Coat: S-W ProMar Interior/Exterior Block Filler B25W00035  
(75-125 sq.ft./gal.)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint B3OW12650  
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint B3OW12650  
(4 mils wet, 1.4 mils dry per coat)

C. CONCRETE - (Floors)

1. Alkyd Systems:

a. Gloss Finish:

1st Coat: S-W Industrial Enamel, B54Z Series  
2nd Coat: S-W Industrial Enamel, B54Z Series  
(4 mils wet, 2 mils dry per coat)

D. METAL - (Aluminum)

1. Latex Systems:

a. Semi-Gloss Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
(4 mils wet, 1.5 mils dry per coat)

E. METAL - (Galvanized)

1. Latex Systems:

a. Semi-Gloss Finish:

1<sup>st</sup> Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series

(4 mils wet, 1.3 mils dry per coat)

b. Flat Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12650  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12650  
(4 mils wet, 1.4 mils dry per coat)

F. METAL - Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Sashes, Doors, Partitions, Cabinets, Lockers, Fixtures, Equipment, Copper, Non-Galvanized Metal

1. Latex Systems:

a. Gloss Finish:

1st Coat: 1<sup>st</sup> Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
(4 mils wet, 2 mils dry per coat)

b. Semi-Gloss Finish:

1st Coat: 1<sup>st</sup> Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B3IW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B3IW12651 Series  
(4 mils wet, 1.3 mils dry per coat)

c. Flat Finish:

1st Coat: 1<sup>st</sup> Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
3rd Coat: S-W ProMar 200 Latex Flat Wall Paint, B3OW12651  
(4 mils wet, 1.4 mils dry)

G. WOOD - Walls, Ceilings, Doors, Trim, Cabinet Work, Counters, Partitions, Frames Including Sitka Spruce, Southern Pine, Douglas Fir, Cedar, Redwood, Lauan)

1. Latex Systems:

a. Gloss Finish:

1st Coat: S-W Premium Wall & Wood Primer, B28W81111  
(4 mils wet, 2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
(4 mils wet, 2 mils dry per coat)

b. Semi-Gloss Finish:

1st Coat: S-W Premium Wall & Wood Primer, B28W81111  
(4 mils wet, 2 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31W02651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31W02651 Series  
(4 mils wet, 1.5 mils dry per coat)

c. Egg-Shell Finish:

1st Coat: S-W Premium Wall & Wood Primer, B28W81111  
(4 mils wet, 2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series  
(4 mils wet, 1.5 mils dry per coat)

d. Flat Finish:

1st Coat: S-W Premium Wall & Wood Primer, B28W81111  
(4 mils wet, 2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
(4 mils wet, 1.4 mils dry per coat)

2. Stained & Varnished (Clear Finish)

a. Open Grained Wood:

1st Coat: S-W Wood Classic 250 Stain A49 Series  
2nd Coat: S-W SHERWOOD Natural Filler, D7OTI  
3rd Coat: Minwax Fast Dry Oil Base Varnish, Gloss A66V00391  
4th Coat: Minwax Fast Dry Oil Base Varnish, Gloss or Satin  
A66V00391 Series

b. Closed Grain Wood:

1st Coat: Minwax 250 Stain A49 Series  
2nd Coat: Minwax Fast Dry Oil Base Varnish, Gloss A66V00391  
3rd Coat: Minwax Fast Dry Oil Base Varnish, Gloss or Satin A66V00391 Series  
(4 mils wet, 1.5 mils dry per coat)

H. WOOD - (Floors-Stained, Varnished)

1. Urethane System:

a. Gloss Finish:

1st Coat: S-W Oil Stain  
2nd Coat: S-W Polyurethane Varnish, A67VI/A67FI  
3rd Coat: S-W Polyurethane Varnish, A67VI/A67FI  
(4 mils wet, 1.5 mils dry per coat)

I. DRYWALL - (Walls, Ceilings, Gypsum Board, Etc.)

1. Latex Systems:

a. Gloss Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer, B28W02600

(4 mils wet, 1.2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B2IW12651 Series  
(4 mils wet, 2 mils dry per coat)

b. Semi-Gloss Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer, B28W02600  
(4 mils wet, 1.2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B3IW02651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B3IW02651 Series  
(4 mils wet, 1.3 mils dry per coat)

c. Egg-Shell Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer, B28W02600  
(4 mils wet, 1.2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series  
(4 mils wet, 1.6 mils dry per coat)

d. Flat Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer B28W02600  
(4 mils wet, 1.2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
(4 mils wet, 1.4 mils dry per coat)

J. TECTUM PANEL FIELD PAINTING

1. Recommended: Sherwin Williams  
Product: Waterborne Acrylic Dry Fall (B42W1) 50 Gal. Drums

2. Recommended Spread Rate per Coat

Wet Mils: 3.5 – 5.0  
Dry Mils: 1.5 – 2.0  
Coverage: 336 – 450 sq. ft./gallon approximate (based on flat surface)  
\*If necessary, cross spray at a right angle

3. Application Condition

Temperature: 50 deg. F minimum, 110 deg. F maximum (air, surface, and material)  
At least 5 deg. F above dew point  
Relative Humidity: 75% maximum  
Dry Time: 20 minutes  
Recoat: 1 hour

4. Application Equipment

The following is a guide. Changes in pressure and tip sizes may be needed for proper spray characteristics.

Airless Spray:  
Pressure 2800  
Hose fb" ID  
Tip 0.013"  
Reduction As needed up to 10% by volume

Conventional Spray:  
Gun Binks 95  
Fluid Nozzle 63C  
Air Nozzle 63PB  
Atomization Pressure 60 psi  
Fluid Pressure 50 psi  
Reduction As needed up to 20% by volume

END OF SECTION 099123

## SECTION 099300 – STAINING AND TRANSPARENT FINISHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
  - 1. Interior Substrates:
    - a. Dressed lumber (finish carpentry or woodwork).
    - b. Wood-based panel products.

#### 1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of product.
- C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
  - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square

2. Apply coats on Samples in steps to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

#### 1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of stain color selections will be based on mockups.
    - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Products shall be selected to match the stain color and finish of the wood wall and ceiling panels.

### 2.2 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base.
  - 1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
  - 2. Shellacs, Clear: VOC not more than 730 g/L.
  - 3. Stains: VOC not more than 250 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
- D. Low-Emitting Materials: Interior stains and finishes shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Stain Colors: As selected by Architect from manufacturer's full range. Stain shall be selected to match the color of the wood wall and ceiling panels.

### 2.3 SOURCE QUALITY CONTROL

- A. Testing of Materials: Owner or Owner's agent reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from

previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
  - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
  - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
  - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
  - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
  - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
  - 2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
  - 3. Sand surfaces exposed to view and dust off.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

### 3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  1. Use applicators and techniques suited for finish and substrate indicated.
  2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
  3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

### 3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

- A. Wood Substrates: Wood trim, architectural woodwork, wood benches, and wood board paneling and custom wood casework.
  1. Moisture-Cured Clear Polyurethane over Stain System, MPI INT 6.3Y:
    - a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90. Stain to match wood wall & ceiling panels provided by Rulon
    - b. First Intermediate Coat: Moisture-cured polyurethane matching topcoat.
    - c. Second Intermediate Coat: Moisture-cured polyurethane matching topcoat.
    - d. Topcoat: Varnish, polyurethane, moisture cured, finish to match wood wall & ceiling panels provided by Rulon.
  - 1) Sher-Wood® Kem Aqua® Plus Clear, medium rub finish

END OF SECTION 099300



## SECTION 099600 – ELASTOMERIC COATINGS OVER CEMENT BOARD

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Provide all labor, materials and equipment necessary to install the “PERM-FLEX JC” Coating Assembly from STUC-O-FLEX. The assembly consists of Elastomeric Joint Compound, Fiberglass Reinforcing Detail Mesh, Prime Seal and Stuc-O-Flex finish applied to cement board substrates.
- B. Related work specified elsewhere:
  - 1. Sealant section 07900.
- C. Terms and Definitions:
  - 1. ELASTOMERIC JOINT COMPOUND Acrylic polymer based material which functions as a water resistant bridging compound to flush, smooth and reinforce seams, butt joints and corners.
  - 2. STUC-O-FLEX REINFORCING FIBERGLASS MESH Detail Mesh, 6" wide rolls of a balanced open weave fiberglass mesh specially treated for compatibility, as supplied by STUC-O-FLEX INTERNATIONAL (optional, except for inside and outside corners).
  - 3. PRIME SEAL Acrylic based stain blocking primer, helps to protect substrate from moisture during the application of materials and provides for uniform substrate porosity which could discolor finish coat.
  - 4. STUC-O-FLEX finish coat as manufactured by STUC-O-FLEX INTERNATIONAL, factory premixed, acrylic based, color integrated, textured finish for use with PERM-FLEX system. Numerous textures can be achieved using a variety of application methods. Spray or trowel applied - Sand finish, skip trowel, knock down, lace, etc. Provided in 20 standard colors. Special colors upon request, see STUC-O-FLEX standard color chart for details.
  - 5. Water shall be clean and potable in clean containers without any residue or foreign materials.
  - 6. Sealant system (CAULKING), Shall be of appropriate quality and design to prevent water intrusion behind the coatings. Consult manufacturers for specific details and specification.
  - 7. Accessories, Casing & corner beads, trim pieces, expansion & control joints, etc., used in conjunction with design system as required by specific project conditions (by design professional).

#### 1.02 QUALITY ASSURANCE

Optional but Encouraged - “WaterWay Rainscreen & Ventilation Mats” create space between your building and the elements. They also contribute to air circulation and ventilation when properly designed. Water drainage and increased air flow will enhance drying and in turn reduce the

potential damage resulting from water penetration. A Polymer core of fused, entangled filaments in varying thicknesses from a nominal ¼ inch to ¾ inch bonded to a moisture resistant filter fabric on the outer surface. [http://www.stucoflex.com/rainscreen\\_drainage\\_mats.html](http://www.stucoflex.com/rainscreen_drainage_mats.html)

A. Applicator Requirements

1. Applicator shall be licensed, insured and competent to accurately install the products consistent with construction documents and specifications. Manufacturer is not responsible for application.

B. Approvals

1. The system shall be recognized for the intended use by applicable building codes.

C. Design Consideration

1. Deflection of the substrate system shall not exceed  $l/240$ .
2. Minimum slope shall be 4 : 12 pitch.
3. Expansion Joint Requirements:
  - a. Where building or substrate expansion joints occur.
  - b. At floor lines in wood frame construction.
  - c. Where dissimilar substrates occur.
  - d. Locations where the system abuts alternate building materials.
  - e. As determined by design professional
4. Stuc-O-Flex coating material terminations to windows, doors, air conditioning units, electrical boxes, etc. shall provide adequate space for proper waterproof transition. Under no circumstances shall Stuc-O-Flex be responsible for integrity or design.
5. Stuc-O-Flex coatings shall terminate at a minimum 2" inches above grade.
6. Sealant system shall be compatible with Stuc-O-Flex and adjacent building product. Consult sealant manufacturers for recommendations.
7. All substrate sheathing systems should incorporate code compliant weather resistive barrier and a mechanism for water drainage.
8. Substrate systems shall have no surface irregularities greater than ¼ in 8 feet.

D. Framing (general guidelines)

1. Maximum spacing shall be 24" O.C. when using 1/4" cementitious substrate over nominal 1/2" sheathing or nominal 1/2" cementitious substrate over open framing.
2. Blocking shall be required in some cases to ensure all sheathing butt joints (edges) fall on a structural member preventing movement of substrate sheathing.  
(Substrate integrity is important to final appearance of completed walls)

E. Substrate Sheathing (general guidelines)

1. Moisture content of sheathing shall not exceed 19% during installation and remain so throughout PERM-FLEX assembly application.
2. Install substrate sheathing with a 1/32" to 1/16" gap between pieces to allow for expansion and contraction.
3. Sheathing butt joints shall be parallel and fastened to studs 6" O.C. with fasteners no closer than 3/8" from edge.

### 1.03 SUBMITTALS

#### A. Samples:

1. The applicator shall, before the project commences, provide the owner or architect, a sample of suitable size of each color and texture as specified for the project for purposes of obtaining approvals.
2. Each sample shall be prepared using the same tools and techniques as required for the actual application.
3. An approved sample shall be available and maintained at the job site.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver all material supplied by the manufacturer in original, unopened packages with legible manufacturer's identification and labels intact.
- B. Store all products supplied by STUC-O-FLEX in a cool dry place, out of direct sunlight, protected from weather and other damage. In addition, the materials shall be stored in tightly sealed containers at a temperature of not less than 40°F at all times.

### 1.05 JOB CONDITIONS

#### A. Weather and Environmental Conditions

1. Application of Stuc-O-Flex Coatings shall not take place during inclement weather unless appropriate protection is employed.
2. Stuc-O-Base Coat and Stuc-O-Flex Elastomeric Finish shall be protected against freezing temperatures, rain, or water splash for a period of at least 48 hours. The job should be tented and a heat source provided if there is a projected drop in the temperature below 40°F during the first 24 hours after application of Base coat or Finish coat.

### 1.06 COORDINATION AND SCHEDULING

- A. The work in this section requires close coordination with related sections and trades.
- B. The tops of all walls must immediately be protected to prevent water infiltration behind the exterior wall assembly. The cap flashing should be installed immediately after the Finish coat has been cured.
- C. Sealant and waterproofing materials shall be installed in a timely manner as to prevent water intrusion behind the Stuc-O-Flex coatings.

### 1.07 MAINTENANCE

- A. Sealant and other components of the structure must be inspected periodically to confirm performance as originally installed. Corrections shall be made at once.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

All Stuc-O-Flex Coating products shall be obtained from STUC-O-FLEX INTERNATIONAL, INC., as manufacturer, or its authorized supplier or distributor. Contact:

Stuc-O-Flex International, Inc.  
17639 NE 67<sup>th</sup> Court  
Redmond, WA 98052  
800-305-1045  
[info@stucoflex.com](mailto:info@stucoflex.com)      [www.stucoflex.com](http://www.stucoflex.com)

### 2.02 MATERIALS

- A. ELASTOMERIC JOINT COMPOUND Acrylic polymer-based material which functions as a water resistant bridging compound to flush and smooth out uneven seams and butt joints.
- B. STUC-O-FLEX REINFORCING FIBERGLASS MESH Detail Mesh, 6" wide rolls of a balanced open weave fiberglass mesh specially treated for compatibility, as supplied by STUC-O-FLEX INTERNATIONAL (optional, except for inside and outside corners).
- C. PRIME SEAL Acrylic based stain blocking primer, protects substrate from moisture and prevents bleed through which would discolor finish coat.
- D. STUC-O-FLEX finish coat as manufactured by STUC-O-FLEX INTERNATIONAL, factory premixed, acrylic based, color integrated, textured finish for use with PERM-FLEX system. Numerous textures can be achieved using a variety of application methods. Spray applied or hawk & trowel - Sand finish, skip trowel, knock down, lace, etc. Provided in 20 standard colors. Special colors upon request, see STUC-O-FLEX standard color chart for details.
- E. Water shall be clean and potable in clean containers without any residue or foreign materials.
- F. Sealant system (CAULKING), Shall be of appropriate quality and design to prevent water intrusion behind the coatings. Consult manufacturers for specific details and specification.
- G. Accessories, Casing & corner beads, trim pieces, expansion & control joints, etc., used in conjunction with designated wall system as required by specific project conditions

### 2.03 PROPERTIES

The Stuc-O-Flex coatings comply with following test standards:

TEST	METHOD	RESULT
ELONGATION % (FINISH)		105 Percent
WATER VAPOR TRANSMISSION	ASTM-E96	14 GRAINS PER HOUR / SQ. FT. (AVERAGE)
SALT SPRAY RESISTANCE	B-117	300 HOURS NO DELETERIOUS EFFECTS



ACCELERATED WEATHERING	G-23-81	2000 HOURS NO DELETERIOUS EFFECTS
ABSORPTION FREEZE THAW	60 CYCLES	NO CRACKING, CHECKING
TENSILE BOND	ASTM C-297	127.9 PSI
WATER PENETRATION TEST	ASTM-E-331	NO WATER PENETRATION OCCURRED ON SUBSTRATE
WATER RESISTANCE TEST	ASTM D-2247	NO CRACKING, BLISTERING, PEELING OR COMPROMISE
MILDEW / FUNGUS RESISTANCE	810 B	NO MOLD OR MILDEW GROWTH DURING TEST
WIND DRIVEN RAIN		NO DELAMINATION, NO WATER INTRUSION
FIRE TESTING TUNNEL TEST	ASTM E-84	FLAME SPREAD < 25 SMOKE DEVELOPED < 450 CLASS "A" FIRE RATED

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Prior to proceeding, carefully inspect preparatory and installed work of other trades and verify that such work is correct and completed to the point where Stuc-O-Flex product installation may properly proceed.
- B. Substrate shall be dry, sound and free of release agents (silicones, oils, etc.), paint and other residue or coatings.
- C. The substrate shall have no planar irregularities greater than 1/4" in 8 feet.
- D. Notifications - The General Contractor and the Architect shall be advised of any discrepancies. Work shall not proceed until all unsatisfactory conditions are corrected and the substrate is acceptable, clean and free of any contaminants, including completion of all appropriate flashing and other waterproofing details.

### 3.02 INSTALLATION

- A. ACCESSORIES: expansion joints, corner & casing bead, L or J channel where required, shall be installed as the first step in conjunction with or directly after the sheathing is set.
  1. Accessories shall be installed in accordance with manufacturer's recommendations, although fastening schedule shall be a maximum of 8" O.C.
  2. Installation at this time insures accessories will be fully embedded in Joint Compound and fiberglass reinforcing mesh, providing a structurally sound, aesthetically pleasing detail.
- B. ELASTOMERIC JOINT COMPOUND & FIBERGLASS REINFORCING MESH: Using a stainless steel trowel or sheetrock knife apply Joint Compound mixture to all seams and butt joints providing a smooth joint detail and transition from one piece of sheathing to the next. Immediately embed detail mesh into wet Elastomeric Joint Compound by troweling from the center to the ends/edges, causing fabric to be embedded into coating. Nailing

flanges on vinyl windows shall also receive Elastomeric Joint Compound and mesh to seal and flatten transition to cement sheathing (Unless windows are mounted prior to cement substrate). This step is very important to the aesthetics of your project. In some cases a second coat of Joint Compound may be required to insure a smooth flat surface is secured.

1. Allow to dry minimum 24 hours or until dried below 19% moisture content.
  2. Mesh will be continuous, flat and wrinkle free over all seams, joints and trim accessories. All ends shall be overlapped 2.5 inches.
- C. PRIME SEAL: Apply primer with airless sprayer, medium nap roller, or paint brush to all areas that Stuc-O-Flex finish coat is to be applied. A uniform pinhole free layer should be provided to insure no shadowing or discoloration will occur from substrate sheathing. Allow to dry completely.
- D. STUC-O-FLEX ACRYLIC FINISH COAT: Apply in color and texture as approved by Architect and/or client using stainless steel trowels or appropriate spray equipment with sufficient manpower and equipment to insure a continuous operation without cold joints, scaffolding lines, etc. Finished wall sections shall match approved sample. Coverage and thickness shall vary depending on texture desired and specified final appearance.
1. Mix STUC-O-FLEX prior to use with paddle type blade to insure consistency.
  2. Small amounts of water may be added to adjust viscosity. 12oz. maximum per 5 gallon pail.

### 3.03 JOB SITE CLEAN UP

- A. All excess STUC-O-FLEX wall coating materials shall be removed from the job site by the STUC-O-FLEX applicator.

END OF SECTION 099600

## SECTION 099610 – HIGH-PERFORMANCE WALL COATINGS

### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. Furnish all necessary material, labor, and equipment required to prepare designated areas and install an Interior Wall Coating System.

#### 1.02 RELATED WORK

- A. All drawings and general provisions of contract including General and Special Conditions and Division I, excepting special Submittal and Quality Assurance provisions in this section.

#### 1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Obtain Interior Wall Coating System materials from a single manufacturer with a minimum of 5 years verifiable field installation experience providing antimicrobial system materials of the type specified in this section.
- B. Contractor's Qualifications: Installation must be performed by a manufacturer approved contractor with skilled mechanics having not less than 5 years satisfactory experience in the installation of the type of system as specified in this section, and must be approved in writing by the manufacturer of the Interior Wall Coating System.

#### 1.04 WARRANTY

- A. The contractor and the manufacturer shall furnish a standard guarantee of the Interior Wall Coating System for a period of one year after installation. This labor and material guarantee shall include loss of bond and wear-through to the substrate through normal wear and tear.
- B. Not included in the warranty are damage due to structural design deficiencies including but not limited to slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to fork lifts, other equipment, delamination caused by sub-surface hydrostatic pressure, Acts of God, or other elements beyond the scope of protection of this system nor causes not related to the system materials.
- C. In case of a warranty claim, the owner will notify the manufacturer and contractor in writing within 30 days of the first appearance of problems covered under this warranty, and will provide free access to the area during normal working hours. Property protection is also the owner's responsibility. Remedy is limited to direct repair of the Wall Surfacing System.

## 1.05 SUBMITTAL

- A. Product Data: Submit manufacturer's specifications on cured system and individual components of the Interior Wall Coating System, including physical properties and performance properties and all tests described in part 2.01 B in this section and submit all Material Safety Data Sheets. Each individual component of the system will be evaluated on the basis of these standards. For any of these tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data from an independent test laboratory tested according to the referenced standard. Furnish \_\_\_\_\_ sets of this information. Manufacturer's standard color chart shall also be submitted and must afford the owner color selection from at least \_\_\_\_\_ standard colors. Furnish \_\_\_\_\_ sets of this information.
- B. The contractor shall submit a 6" x 6" system sample for verification purposes and finish texture approval.
- C. Contractor Experience: The contractor shall furnish a list of 5 projects using either specified material or another material pre-approved for this project that they have installed during the last 5 years. Information shall include: project name, square footage, contact name with owner address and phone number. Also, the contractor shall furnish resumes detailing the experience of key project personnel including supervisors and technicians.
- D. It is the intention of this Section to provide the products as named. Substitutions will be considered only when received by the Architect, Engineer or Design Professional through a bidding Prime Contractor at least ten days prior to the date set for receipt of bids. Upon receipt of any such submission, the Architect, Engineer or Design Professional will determine whether or not the proposed product is an approved equal. In the event the Architect, Engineer or Design Professional determines that a proposed system is an approved equal, he will issue an addendum and notify all bidders at least 48 hours prior to receipt of bids. No substitutions will be considered after contract bid date.
- E. The contractor shall submit a copy of the manufacturer's packing slip, tagged for this specific job, along with calculations, signed by an officer of the primary material supplier demonstrating that the quantity of material furnished for the project will achieve the specified coverage and mil thickness.

## 1.06 MATERIAL DELIVERY, HANDLING AND STORAGE

- A. Primary system materials shall be delivered in the manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the following:
  - Product name(s) and/or Number(s)
  - Manufacturer's name
  - Component designation (A, B, etc.)
  - Product Mix Ratio
  - Health and Safety Information
  - CHEMTREC Emergency Response Information
- B. Provide equipment and personnel to handle the materials by methods which prevent damage.
- C. The contractor shall promptly inspect direct jobsite material deliveries to assure that quantities are correct, comply with requirements and are not damaged.

- D. The contractor shall be responsible for materials furnished by him, and he shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.
- E. Store material(s) in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer's maximum recommended shelf life.

## 1.07 JOB CONDITIONS

- A. The contractor shall visit the jobsite prior to beginning the installation of the Interior Wall Coating System to evaluate substrate condition, including substrate moisture content, and the extent of repairs required, if any. Concrete substrates shall be tested to verify that the moisture content of the substrate does not exceed Interior Wall Coating System manufacturers' recommendations. Cost of repair and remediation of the substrate cannot be predicted prior to inspection and testing, and therefore is not encompassed within the installation estimates.
- B. The contractor should exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment. The contractor shall use his discretion as to the physical means used for preparation and protection. Any costs incurred for resultant damage from negligence or inadequate protection shall be the sole responsibility of the contractor.
- C. Job area to be free of and protected from the activities of other trades during installation and for a period of time recommended by the manufacturer upon completion of the job.
- D. The minimum substrate temperature must be conditioned to 60° F before commencing installation, during installation, and for at least 72 hours after installation is complete.
- E. Use of respirators and/or adequate ventilation must be provided.
- F. Maintain lighting at a minimum uniform level of 50 or more foot candles in all areas where the Interior Wall Coating System is being installed. It is the recommendation of the manufacturer that the permanent lighting be in place and working during the installation.
- G. All leaks from pipes and other sources must be corrected prior to the installation of the Interior Wall Coating System.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. System Overview: The Interior Wall Coating System shall be the General Polymers SANIGLAZE High Build Wall System, as manufactured by Sherwin-Williams consists of an optional approved Block Filler, two coats of 3479 Water-Based Epoxy Wall Coating and 4410 WB Polyurethane as Optional finish coat.
- B. Typical Physical Properties @ 73°F (unless otherwise noted)
 

Colors	Tinted to SW Color selected by Architect
Hardness, Shore D	65/60

ASTM D 2240		
Tensile Strength		6,000 psi
ASTM D 412		
Adhesion		300 psi
ACI 503R		Substrate Failure
Flammability		Self Extinguishing on Substrate
Thermal Cycling		No cracking
ASTM C	884	
(24 hours, 6°F to 77°F)		
Permeability		≤ 0.01 gm/ft <sup>2</sup> /24 hrs
MIL-I-16923		/inch thickness
@ 95% humidity		

## PART 3 - EXCECUTION

### 3.01 SURFACE PREPARATION

- A. Proper surface preparation prior to installation of materials is essential for interior wall coating systems. Read the following recommended methods of surface preparation carefully. Consult manufacturer for answers to questions prior to installation.
  1. Closely examine all substrates for undulation, cleanliness, holes, cracks and soundness.
  2. Surface contaminants must be removed by mechanical abrasion or other approved methods to ensure proper adhesion of the system.
  3. Substrate finish will affect the final appearance of the wall coating.  
 Drywall: Level #4 Finish utilizing materials compatible with the wall board product and the resinous wall coating system.  
 Cast-in-Place Concrete: Fill bugholes with compatible material and apply skim coat as needed for desired smoothness.  
 Unit Masonry: Apply block filler recommended by manufacturer.
  4. Surface and air temperature should be a minimum of 50° F / 15° C
  5. Air movement must be present in application area to prevent surface condensation during installation.

### 3.02 INSTALLATION

- A. General  
 Apply each component of the Interior Wall Coating System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions.  
  
 If necessary, install Pre-formed Vinyl Corner Moldings with fast setting, high strength adhesive.
- B. Optional Surface leveling materials depending upon substrate  
 Bughole Filler, Block Filler, etc as approved by Manufacturer
- C. Primer  
 3479 Water-Based Epoxy Wall Coating

D. Base Coat  
3479 Water-Based Epoxy Wall Coating (two coats)

E. Optional Finish Coat  
4410 WB Polyurethane

### 3.03 CURING, CLEARNING AND PROTECTION

- A. Cure all Interior Wall Coating System materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.
- B. Protect the Interior Wall Coating System from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.
- C. Clean the Interior Wall Coating System just prior to final inspection, using materials and procedures suitable to the system manufacturer.
- D. Some cleaners will affect the color or texture of your polymer wall surfaces. To determine how your cleaner will perform, first test each cleaner, in a small area, utilizing your cleaning technique. This precaution will demonstrate the effect of your cleaner and technique. If no deleterious effects are observed, continue with the procedure. If deleterious effects do occur, modify the cleaning material and/or procedure.

END OF SECTION 099600





## SECTION 099630 – ELASTOMERIC COATINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes surface preparation and application of elastomeric coatings to exterior surfaces.

#### 1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Stucco: A portland cement-based plaster used on exterior surfaces.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric coatings that comply with performance requirements specified in MPI 113.
- B. Provide elastomeric coating systems with the following properties as determined by test methods indicated:
  - 1. Elongation: Not less than 100 percent with a tensile strength of 200 psi and not less than 88 percent recovery after 1 hour and 90 percent recovery after 24 hours when tested according to ASTM D 2370 using parameters established by MPI 113.
  - 2. Accelerated Weathering: No cracking, peeling, blistering, chalking, or visual deterioration after 1000 hours when tested according to procedures in ASTM G 155.
  - 3. Low-Temperature Flexibility: No crack formation when tested according to ASTM D 1737.
  - 4. Moisture-Vapor Transmission: Not less than 2.0 perms according to ASTM D 1653.
  - 5. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.
  - 6. Minimum Solids Content by Volume: Not less than 45 percent.

#### 1.5 SUBMITTALS

- A. Product Data: For each elastomeric coating system specified. Include crack fillers, block fillers, and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Technical information including label analysis and instructions for handling, storing, and applying each coating material.
  3. Certification by elastomeric coating manufacturer that products supplied comply with local VOC regulations.
- B. Samples for Initial Selection: For each type of finish-coat material indicated.
1. After color selection, Architect will furnish color chips indicating colors selected.
- C. Qualification Data: For Applicator.
- D. Material Certificates: For each elastomeric coating material, signed by manufacturers.
- E. Product Test Reports: Based on evaluation of comprehensive tests by a qualified testing agency for each elastomeric coating material indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last five years of current product formulations.

## 1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying elastomeric coating systems similar in material and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain crack fillers, primers and other undercoat materials from same manufacturer as finish coats.
- C. Benchmark Samples (Mockups): Provide full-coat benchmark finish samples for each type of coating on each substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample submittals.
1. Architect will select one concrete, masonry and/or stucco exterior wall surface to represent surfaces and conditions for application of elastomeric coatings.
    - a. Wall Surfaces: Prepare samples on at least 5 sq. ft. of wall surface.
  2. Apply benchmark samples according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
  3. Approved benchmark samples will be used to evaluate coating systems.
  4. Obtain Architect's approval of benchmark samples before starting application of coatings.
  5. Final approval of colors will be from benchmark samples.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
  2. Manufacturer's stock number and date of manufacture.
  3. Contents by volume, for pigment and vehicle constituents.
  4. Thinning instructions (if permitted).
  5. Application instructions.
  6. Color name and number.

7. Handling instructions and precautions.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

## 1.8 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F, unless otherwise permitted by manufacturer's written instructions.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

## 1.9 WARRANTY

A. Elastomeric Coating Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period. Failures include, but are not limited to, water penetration through the coating.

B. Warranty Period for Elastomeric Coatings: Five year(s) from date of Substantial Completion.

## 1.10 EXTRA MATERIALS

A. Furnish extra elastomeric coating materials from same production run as materials applied and in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with 2 gal. of each color and finish of elastomeric coating materials applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles (Basis of Design):

1. Stuc-O-Flex International, Inc. (Stuc-O-Flex).

## 2.2 ELASTOMERIC COATING MATERIALS, GENERAL

- A. Material Compatibility: Provide crack fillers, block fillers, primers, elastomeric finish-coat materials, and related materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality elastomeric coating materials that are factory formulated, comply with requirements in FS TT-C-555, and are recommended by manufacturer for the application indicated. Material containers not displaying manufacturer's product identification are not acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance of proposed substitutions.
- C. Colors and Textures: See the Coating Schedule at the end of Part 3 for color selections.
- D. Colors and Textures: Match existing.

## 2.3 CRACK FILLERS

- A. Crack Fillers: Factory-formulated acrylic emulsion crack fillers compatible with substrate and finish-coat materials indicated.

## 2.4 PRIMERS

- A. Concrete and Masonry Primer: Factory-formulated, alkali-resistant, acrylic-latex primer (Basis of Design).
  - 1. Stuc-O-Flex: Prime Seal: Applied as per manufacturers recommendations.
- B. Stucco Primer: Factory-formulated stucco primer (Basis of Design).
  - 1. Stuc-O-Flex: Prime Seal: Applied as per manufacturers recommendations.

## 2.5 ELASTOMERIC FINISH-COAT MATERIALS

- A. Smooth Elastomeric Finish: Smooth, factory-formulated, 100 percent acrylic elastomeric coating (Basis of Design).
  - 1. Stuc-O-Flex: Elastomeric Acrylic Finish: Applied at a minimum thickness of 1/8" with no voids.
- B. Textured Elastomeric Finish: Textured, factory-formulated, 100 percent acrylic elastomeric coating (Basis of Design).
  - 1. Stuc-O-Flex: Elastomeric Acrylic Finish: Applied at a minimum thickness of 1/8" with no voids.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for coating application. Comply with procedures specified in PDCA P4.
  - 1. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are thoroughly dry.
  - 2. Start of coating application will be construed as Applicator's acceptance of surface conditions.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify Architect about anticipated problems when using coatings specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, reinstall items removed, using workers skilled in trades involved.
- B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for particular substrate conditions and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Cementitious Surfaces: Prepare brick, concrete, concrete unit masonry, stucco, and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar impediments to good adhesion by water blasting followed by a clear water rinse.
    - a. Remove mildew and neutralize surfaces according to manufacturer's written instructions before patching materials are applied.
    - b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
    - c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
    - d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. If surfaces are sufficiently alkaline to cause finish paint to blister and burn, correct this condition before application. Do not apply coatings over

surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

3. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.
  4. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initial application of elastomeric coatings.
    - a. Cracks up to 1/16 Inch: Clean surface around cracks. Apply crack filler primer penetrating cracks as deeply as possible, overflowing crack 2 inches on each side. When crack filler primer is dry, apply manufacturer's recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges of primed area around cracks. Allow for sealant shrinkage when applying.
    - b. Cracks up to 3/8 Inch: Open cracks to 1/4 to 3/8 inch wide and 1/8 inch deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply crack filler primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches on each side of cracks. Fill cracks with manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
- D. Material Preparation: Mix and prepare materials according to coating manufacturer's written instructions.
1. Maintain containers used in mixing and applying elastomeric coatings in a clean condition, free of foreign materials and residue.
  2. Stir materials before application to produce a mixture of uniform density. Stir as required during application. If surface film forms, do not stir film into material. If necessary, remove film and strain coating material before using.
  3. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match color of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply elastomeric coatings according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Colors, surface treatments, and finishes are indicated in coating schedule.
  2. Do not paint over conditions detrimental to formation of a durable coating film, such as dirt, rust, scale, grease, moisture, and scuffed surfaces.
  3. Provide finish coats compatible with primers used.
- B. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Number of coats and film thickness required are same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
  2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
  3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat does not cause undercoat to lift or lose adhesion.
- D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's written instructions.
1. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep's wool covers with a 1- to 1-1/4-inch nap as recommended by manufacturer for material and texture required.
  2. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- E. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness as recommended by manufacturer.
1. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of two coats in one pass.
- F. Prime Coats: If recommended by manufacturer, apply a primer to material being coated before applying finish coats.
- G. Roller Application: Keep cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.
- H. Spray Application: Use spray equipment for application only when permitted by manufacturer's written instructions and authorities having jurisdiction.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.
- 3.4 CLEANING
- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by Architect. Leave in an undamaged condition.
- B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
  - 1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

### 3.6 COATING SCHEDULE

- A. Concrete: Provide the following elastomeric coating systems over exterior concrete surfaces:
  - 1. Textured Elastomeric Finish: One finish coat(s) over a primer if required by manufacturer.
    - a. Primer: Concrete and masonry primer.
    - b. Finish Coats: Textured elastomeric finish.
- B. Stucco (Portland Cement Plaster): Provide the following elastomeric coating systems over exterior stucco surfaces:
  - 1. Smooth Elastomeric Finish: One finish coat(s) over a primer if required by manufacturer.
    - a. Primer: Stucco primer.
    - b. Finish Coats: Smooth elastomeric finish.

END OF SECTION 099630



## SECTION 099646 – INTUMESCENT PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes surface preparation and application of fire-retardant intumescent paint for steel.
- B. Related Requirements:
  - 1. Section 099113 "Exterior Painting" for primers and finish coats that may be used with intumescent paint finishes.
  - 2. Section 099123 "Interior Painting" for primers and finish coats that may be used with intumescent paint finishes.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site with Construction Manager.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each intumescent paint finish indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of intumescent paint finish indicated.
  - 1. Submit Samples on rigid backing, not less than 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each intumescent paint.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.7 FIELD CONDITIONS

- A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 45 and 95 deg F.
- C. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- D. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, ForceField FireGuard E-84

### 2.2 INTUMESCENT PAINT MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 0
  - 2. Smoke-Developed Index: 5 or less.
- C. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each material or coat, products and spreading rates shall be as recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.
- D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction

1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 150 g/L.
  3. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
  4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
- E. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Colors and Gloss: White, smooth finish.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.
- B. Begin coating only when moisture content of wood substrate is 15 percent or less when measured with an electronic moisture meter.
- C. Begin coating no sooner than 7 days after substrate is constructed and is visually dry on both sides.
- D. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.
  1. Remove incompatible primers, and re-prime substrate with compatible primers as required to produce coating systems indicated.

2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated surfaces.

### 3.3 APPLICATION

- A. General: Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.
  1. Use equipment and techniques best suited for substrate and type of material being applied.
  2. Coat surfaces behind movable items the same as similar exposed surfaces.
  3. Apply each coat separately according to manufacturer's written instructions.
  4. Finish doors on faces with intumescent finish. Paint tops, bottoms, and side edges with fire-inert finish.
- B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.
  1. Pigmented Finishes: If undercoats or other conditions show through pigmented topcoat/overcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
  2. Clear Finishes: Produce a smooth surface film of even sheen using multiple coats (if required).

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 099646

## SECTION 101100 – VISUAL DISPLAY BOARDS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. White markerboards.
  - 2. Natural-cork tackboards.

#### 1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instruction for each material and component part, including data substantiating that materials comply with requirements.
- B. Shop Drawings: For each type of visual display board required.
  - 1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
  - 2. Include sections of typical trim members.
  - 3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:
  - 1. Chalkboards and Markerboards: Actual sections of porcelain enamel finish for each type of chalkboard and markerboard required.
- D. Samples for Verification: Of the following products, showing color and texture or finish selected. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected. Prepare Samples from the same material to be used for the Work.
  - 1. Visual Display Boards: Sample panels not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on the substrate indicated for the final Work. Include a panel for each type, color, and texture required.
  - 2. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch- (150-mm-) long sections of extrusions and not less than 4-inch (100-mm) squares of sheet or plate. Include Sample sets showing the full range of color variations expected.

#### 1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain visual display boards through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the products indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

#### 1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating chalkboards without field measurements. Coordinate wall construction to ensure actual dimensions correspond to established dimensions.

#### 1.06 WARRANTY

- A. General Warranty: The special porcelain enamel chalkboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Porcelain Enamel Chalkboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.
  - 1. Warranty Period: 50 years from date of Substantial Completion.
  - 2. Warranty Period: Life of the building.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Porcelain Enamel Chalkboards and Marker Boards:
  - a. Best-Rite Chalkboard Co.
  - b. Carolina Chalkboard Co.
  - c. Claridge Products and Equipment, Inc.
  - d. Ghent Manufacturing, Inc.
  - e. Greensteel, Inc.
  - f. Lemco, Inc.
  - g. Marsh Chalkboard Company.
  - h. Nelson Adams Company.
2. Tackboards:
  - a. Best-Rite Chalkboard Co.
  - b. Carolina Chalkboard Co.
  - c. Claridge Products and Equipment, Inc.
  - d. Ghent Manufacturing, Inc.
  - e. Greensteel, Inc.
  - f. Lemco, Inc.
  - g. Marsh Chalkboard Company.
  - h. Nelson Adams Company.

## 2.02 MATERIALS

- A. Porcelain Enamel Chalkboards and Markerboards: Balanced, high-pressure-laminated, porcelain enamel chalkboards of 3-ply construction consisting of face sheet, core material, and backing.
  1. Face Sheet: 0.024-inch- (0.61-mm-), "Vitracite," porcelain enamel clad, Type 1, stretcher-leveled aluminized-steel face sheet, as manufactured by Claridge Products and Equipment. Fuse porcelain enamel coating to steel at approximately 1000 deg F (540 deg C).
    - a. Cover Coat: Provide manufacturer's standard matte-finish cover coat, with color selected from manufacturer's standards.
  2. Core: 3/8-inch- (9.5-mm-) thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
  3. Backing Sheet: 0.015-inch- (0.38-mm-) thick, aluminum-sheet backing.
  4. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.
- B. Natural-Cork Tackboards: Single-layer, 1/4-inch- (6.4-mm-) thick, seamless, compressed fine-grain, bulletin board quality, natural-cork sheet; face sanded for natural finish; complying with MS MIL-C-15116, Type II.
  1. Backing: Factory laminate cork face sheet under pressure to 3/8-inch- (9.5-mm-) thick fiberboard backing.

## 2.03 ACCESSORIES

- A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch- (1.57-mm-) thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.
1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
  2. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible screws or exposed joints.
  3. Field-Applied Trim: Manufacturer's standard slip-on trim.
  4. Field-Applied Trim: Manufacturer's standard screw-on trim with Phillips flat-head screws.
  5. Chalktray: Manufacturer's standard, continuous, Red Oak tray to match existing.
  6. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
    - a. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches (25 or 50 mm) wide, as indicated, integral with map rail.
    - b. End Stops: Provide one end stop at each end of map rail.
    - c. Map Hooks: Provide 2 map hooks for every 48 inches (1220 mm) of map rail or fraction thereof.
    - d. Flag Holder: Provide one flag holder for each room.

## 2.04 FABRICATION

- A. Porcelain Enamel Chalkboards and Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
1. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide a continuous, uniform writing surface.
  2. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches (75 mm) in either direction of equal spacing. Allow 1/4-inch (6.4-mm) clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
    - a. Up to 5 feet (1.524 m), 1 panel.
    - b. More than 5 feet (1.524 m) but less than 9 feet (2.743 m), 2 panels.
    - c. More than 9 feet (2.743 m) but less than 13.5 feet (4.115 m), 3 panels.
    - d. More than 13.5 feet (4.115 m) but less than 18 feet (5.486 m), 4 panels.
- B. Assembly: Provide factory-assembled chalkboard and tackboard units, unless field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
  2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.



3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

## 2.05 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
- D. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
  1. Organic Coating: Thermosetting modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
  2. Color: As selected by Owner from manufacturer's full range of colors.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.
  1. Surfaces to receive chalkboards or markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of chalkboards or markerboards.
  2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.
  3. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level.

Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

- C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

### 3.03 ADJUSTING AND CLEANING

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean units according to manufacturer's written instructions.

END OF SECTION 101100

## SECTION 101200 – DISPLAY CASES

### PART 1 – GENERAL

#### 1.01 DESCRIPTION OF WORK

- A. This section includes Recessed Trophy and Display Cases

#### 1.02 REFERENCED STANDARDS

- A. ASTM E84
- B. ASTM B221

#### 1.03 SUBMITTALS

- A. Shop Drawings: Provide shop drawings for each type of recessed display or trophy case required.
- B. Product Data: Provide technical data for materials specified. Include Material Safety Data Sheets, when applicable.
- C. Samples:
  - a. Manufacturer's color charts.
  - b. Composition samples of material and trim to illustrate finish, color and texture.
- D. Manufacturer's Instructions: Provide manufacturer's installation instructions.

#### 1.04 OPERATION AND MAINTENANCE

- A. Include data on regular cleaning, stain removal, and precautions

#### 1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/smoke rating in tackboards in accordance with ASTM E84.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer shall be a firm engaged in the manufacture of display cases in the United States.
- B. Manufacturer shall have a minimum of 5 years experience in the manufacture of display cases.

#### 1.07 FIELD CONDITIONS

- A. Field measure prior to preparation of shop drawings and fabrication to ensure proper fit.

#### 1.08 WARRANTY

- A. Submit a standard warranty, stating that when installed in accordance with manufacturer's instructions and recommendations, Claridge recessed trophy and display cases are guaranteed for one year against defects in materials and workmanship. Guarantee does not cover normal wear and tear, improper handling, any misuse, or any defects caused by vandalism or subsequent abuse. Guarantee covers replacement of defective material but does not include cost of removal or reinstallation.

## PART 2 – PRODUCTS

### 2.01 MANUFACTURERS

- A. Recessed Display and Trophy Cases – 370 and 1370 Series and 390 Series – as manufactured by Claridge Products and Equipment, Inc., Harrison, Arkansas. Phone: 870-743-2200; Toll Free 800-434-4610; Fax: 870-743-1908

### 2.02 MATERIALS

- A. Recessed Trophy and Display Case Fronts
  - a. Tackable Back Panels: (Select from Claridge Cork; Fabricork; Designer Fabric; Hook-Fab; or Tan Nucork)
  - b. Laminate Back Panels: (Select from Walnut or Oak grained low-pressure laminate finish)
  - c. Standard Sizes -370 and 1370 Series: 4' x 4'; 4'x 6'; 4' x 8'; 4' x 10'; 4' x 12'; 4'x16'. Special sizes on request.
  - d. Standard Sizes – 390 Series: 6' x 6'; 6' x 8'; 6' x 10'; 6' x 12'; 6' x 14'; and 6' x 16'. Special sizes on request.
  - e. Housing: Architect to select from 370 Series with 3-1/2" extruded aluminum angle perimeter trim; 1370 Series with 3-1/2" extruded aluminum perimeter trim with a 2" radius; or 390 Series with 4" wide face.
  - f. Inside depth: Architect to specify inside case depth (up to 24")
- B. Glass Doors: 370 Series - Architect to specify 3/16" tempered hinged or sliding glass doors. (390 Series cases have 1/4" tempered glass sliding doors that slide on ball bearing rollers; fitted with plunger-type locks)
  - a. Sliding glass doors have ground-in finger pulls, doors slide on glides.
  - b. Hinged glass door cases have piano hinge.
    - i. Doors are fitted with flat key tumbler locks.
    - ii. 370 Cases 4' and 6' wide have one pair of doors; 8' and 10' have two; and 12' and 16' have three pair of doors. 390 Cases 6' and 8' wide have two doors; 10' wide cases have three doors; and 12', 14' and 16' wide cases have four doors.
- C. Glass Shelves: Three adjustable glass shelves furnished with brackets and shelf standards. Architect to specify shelf width – 6, 8, 10 or 12-inch wide.
- D. Metal Trim and Accessories: Provide aluminum extrusions as manufactured by Claridge Products and Equipment, Inc. Trim shall be heavy gauge extruded aluminum and shall meet or exceed ASTM B221 alloy standards. Finish to be etched and anodized satin finish. (Color anodized and powder coat finish trim optional.)
- E. Colors: As selected from manufacturer's standard colors. Over 50 standard tackboard colors to choose from. Color charts furnished on request.
- F. Wood Box: (Optional) Architect to specify depth (up to 24") and finish – walnut or oak grained low pressure laminate.
  - a. Wood box furnished 16" deep unless otherwise specified
  - b. Wood box shipped KD.
- G. Options: Lights; custom sizes; custom styles

### 2.03 FABRICATION

- A. Shop assembly: Provide factory assembled cases to requirements indicated on shop drawings.
- B. Units shall be of dimensions shown in details and in accordance with manufacturer's shop drawings, as approved by architect.

## PART 3 – EXECUTION

### 3.01 PROJECT CONDITIONS

- A. Verify before installation that interior moisture and temperature approximate normal occupied conditions.
- B. Verify that wall surfaces are prepared and ready to receive cases.

### 3.02 INSTALLATION

- A. Deliver cases KD to be reassembled on job.
- B. Follow manufacturer's instructions for storage and handling of units before installation.
- C. Install level and plumb, in accordance with manufacturer's recommendations.

### 3.03 ADJUST AND CLEAN

- A. Verify that all accessories are installed as required for each unit.
- B. At completion of work, clean glass surfaces, back panels and trim, in accordance with manufacturer's recommendations, leaving all materials ready for use.

END OF SECTION 101200



## SECTION 101419 – INTERIOR SIGNS

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Contractor to provide interior signs for rooms identified in the scope of work. Sign contractor to provide all necessary graphic layouts required for client approvals, complete message schedule keyed to floor plans and allow for three meetings with client to present and finalize signage design.
- B. Section includes: Interior non-illuminated directional, control and information surface mounted signage as complete integrated modular system.
- C. Unit prices: Provide unit price for each type unit in designated system for extra possible required signage.

#### 1.02 REFERENCES

- A. Standards of the following as referenced:
  - 1. American National Standards Institute (ANSI).
- B. Industry standards:
  - 1. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336 (ADA).
  - 2. ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 1986 edition.
  - 3. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 36: Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, Final Rule, July 26, 1991.
  - 4. Federal Register Part II, Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1191: Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Amendment to Final Guidelines, September 6, 1991.

#### 1.03 DEFINITIONS

- A. Terms:
  - 1. Braille: Grade II Braille including 189 part-word or whole word contractions; see SYSTEM DESCRIPTION Article below.
  - 2. Non-tactile: Letters and numbers on signs with width-to-height ration between 3:5 and 1:1 and stroke width ratio between 1:5 and 1:10 using upper case "X" to calculate ratios. Use Interstate and Helvetica 65 typestyles; upper and lower case lettering is permitted; serif type styles are permitted; see SYSTEM DESCRIPTION Article below.
  - 3. Symbols: Symbol itself is not required to be tactile but equivalent verbal description is required both in tactile letters and Braille for all ADA signage.

4. Tactile: 1/32" raised capital letters without serifs, at least 5/8" height and not more than 2" height based on upper case "X". Braille is required whenever tactile is required; see SYSTEM DESCRIPTION Article below.

#### 1.04 SYSTEM DESCRIPTION

- A. Signage under this section is intended to include items for identification, direction, control and information of building, and to be installed as a complete integrated system.

1. Interior sign plaques and way finding signs

2. Vinyl Die Cut graphics

3. Dedication Plaque

4. Bulletin Boards and Directories.

- B. ADA design requirements:

1. Signage requiring tactile graphics:

- a. Wall mounted signs designating permanent rooms and spaces, such as room numbers, restrooms, electrical closets, mechanical rooms and fire stair identifications.
- b. Individually applied characters are prohibited.

2. Signage not requiring tactile graphics but requiring compliance to other ADA requirements: All other signs providing direction to or information about function of space, such as directional signs (signs with arrow), informational signs (operating hours, policies, etc.), regulatory signs (no smoking, do not enter) and ceiling and projected wall mounted signs.

- C. ADA performance requirements:

1. Tactile graphics sign mounting requirements:

- a. Single doors: Mount 60" to sign centerline above finished floor and on wall adjacent to latch side of door, as shown on drawings.
- b. Openings: Mount 60" to sign centerline above finished floor adjacent to opening.
- c. No wall space adjacent to latch side of door, opening or double doors: Mount 60 " to centerline above finished floor on nearest adjacent wall.

#### D. VINYL APPLIED CHARACTERS

Vinyl Applied Characters: 3M Series 220 high performance vinyl,

Color: White.

Height: As indicated on Drawings.

Character Style: Helvetica.

#### 1.05 SUBMITTALS

- A. Product data:



1. Manufacturer's signed statement regarding compliance with QUALITY ASSURANCE Article.
2. Manufacturer's product literature indicating units and designs selected.
3. Evidence of manufacturer's computerized data retrieval program for tracking of project for sign typography, message strip requirements and other pertinent data from schedule input to final computerized typography on finished product.

B. Shop drawings:

1. Indicate materials, sizes, configurations, applicable substrate mountings.
2. Typography sample for message strips and header copy.
3. Artwork for special graphics.

C. Samples:

1. Full size samples for specific sign types, if requested by architect, in colors specified. Samples will not be returned for use in project.
2. Submit 6" x 6" color samples as required by the architect.

D. Contract close out:

1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for ordering new signage as required by Owner.
2. Provide an 8½" x 11" re-order form for each sign type and component of each sign type. Forms must be keyed to sign type shown in bid documents using same sign type number.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer qualifications: Work under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.
- B. Pre-installation conference: Closely coordinate tolerances required in this section for completely coordinated and smooth installation.
- C. Installer must be regularly engaged in work of this magnitude and scope for minimum of five years.
- D. All work shall conform to applicable codes.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver all signs in fiber board foam, packed and protected for timely installation, minimizing on-site storage time.
- B. Sign contractor to store all signs in a secured area, out of weather and protected, during installation.

## 1.08 SEQUENCING AND SCHEDULING

- A. Schedule system installation after related finishes have been completed, and in schedule with the project phased construction.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURED UNITS

- A. Acceptable product suppliers:
  - 1. Designer Sign Systems, 352 Washington Avenue, Carlstadt, NJ 07072  
Phone: (201) 939-5577; Fax: (201) 939-7043 (basis for specifications)
  - 2. Lettera Signs, 1209 Bronx River Avenue, Bronx NY 10472  
Phone (718) 991-1000, fax (718)542-4218
  - 3. APCO , 388 Grant Street, SE, Atlanta Georgia,  
Phone: 404-688-9000, fax 404-577-3847

### 2.02 SUBSTITUTIONS

- A. Prior to presentation of bid proposals, bidders shall submit to the architect/designer a written request for approval of materials, article or piece of equipment which they propose as equal or superior to that specified.
  - 1. Submissions of such items for consideration by the architect/designer shall be made a minimum of five (5) days prior to bid opening. Submission shall include:
    - a. Specifications or other descriptive literature addressing each of the points called for in the specifications, preferably in the same order as the specifications.  
Literature should address only the products the supplier intended to provide, not the manufacturer's entire product line.
    - b. Submissions must be addressed to architect or as directed by owner.  
Ref. SPECIFIC JOB NAME
- B. If, in the judgment of the architect/designer, the material, article or piece of equipment is acceptable, approval will be given in an addendum (a) issued to all bidders on record by the architect/designer, a minimum of five (5) days prior to bid opening.

### 2.03 ADA and SUBSURFACE PLAQUE CONSTRUCTION

- A. Tactile copy and Grade II Braille are to be precision embossed a minimum of .032" and formed as an integral part of the sign face. Braille is to be the same color as the sign background with no interruption of the smooth, clean surface of the sign. All plaque edges to be clean, smooth, free of all saw and tooth marks and painted to match the background color of the sign. ADA compliant fabrication is required for all signs. Phenolic photopolymer is NOT acceptable. Lettering, Braille and symbols to be raised 1/32". Braille cell to be 1/4", character height to be 5/8" min., 2" max. Interline spacing to be half of cap height. Braille cell to be 1/4" min. below line of copy above.

- B. Manufacturer's standard embossed, monolithic tactile plaque sign construction to meet relevant ADA requirements indicated for materials, thickness, finish, colors, designs, shapes, sizes and details of construction. Installed dimensional tolerances to be plus/minus 1/32".

1. Sign Face: .010" transparent polycarbonate with a mar resistant ADA compliant fine velvet finish; precision embossed to form copy and Grade II Braille as an integral part of the sign face. Background color is applied subsurface. Copy colors are a subsurface applied abrasion resistant pigment with a satin finish. Embossed copy and Braille cavities are backfilled, providing solid copy and Braille. Braille is the same color as the sign face background with no interruption of the surface of the sign face. Sign face is laminated to .125" plastic base.
2. Raised copy/Braille: Sign copy and Braille to be raised 1/32" min. from plaque first surface by by manufacturer's embossing process. Precisely formed, uniformly opaque Braille to meet relevant ADA regulations and the requirements indicated for size, style, spacing, content, position and colors. Embossed graphic cavities are backfilled providing solid copy and Braille. Translation of sign copy to be the responsibility of the manufacturer.
3. Subsurface reverse screened acrylic sign components, consisting of .080 matte acrylic panels laminated to 1/8 clear acrylic back plate. All edges to be clean and smooth free of any tooling marks. Screen printed images to be produced with screen mesh suitable to provide consistent crisp, clear images (minimum 280 mesh).
4. All symbols and letter forms are to faithfully reproduce specified letter, alpha/numeric and symbol forms.
5. Mounting: Plaque sign mounts with 3M 1/32" double-sided vinyl tape, or foam tape. (VERIFY WALL PAINT FINISH TO DETERMINE PROPER TAPE TO BE USED).  
Option: Mechanical mounting using tape mounting as noted above and also using 4 tamper proof screws to nylon wall shields for masonry and sheet rock construction.
6. Dedication plaque

Stainless steel building dedication plaque. Fabricate from tempered 3/16" stainless steel plate, alloy #304 with a #6 horizontal grain finish. Graphics to be acid etched to 1/32" minimum. All copy to be clear and free of ragged edges or other imperfections. Fill copy with a two part epoxy ink suitable for the use intended. All edges to be clean, smooth and free of any tooling marks. Clear coat entire plaque with a semi gloss sealer suitable for both interior and exterior use. Plaque to mount with 1/4" diameter stainless steel pins welded or drilled and tapped to the rear surface.

7. Directories and bulletin boards

- a. Wall mounted directory and bulletin boards 2-1/2" deep in sizes as shown on the drawings. Custom engineered one piece seamless fiber reinforced polyester (FRP) monolith consisting of initial gel coat sealing layer with multi layers of thermoset polyester resin and glass fiber strands molded in form moulds maintaining module configuration to 3/16" thickness. Provide structural reinforcement within each unit to prevent racking and misalignment. Top and bottom edges to have manufacturer's standard bevel edge. Glazing to be E.I. Dupont de Nemours and Company Inc. Lucite 8 SAR 3/16" thickness super abrasion resistant clear acrylic plastic.
- b. Unit to have manufacturer's standard bevel edge. Glazing to be E.I. Dupont de Nemours and Company Inc. Lucite 8 SAR 3/16" thickness super abrasion resistant clear acrylic plastic.

## 2.04 FABRICATION

### A. Shop Assembly:

1. Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with reviewed shop drawings.
2. Provide copy required on inserts, message strips, headers or bases and covers required on reviewed shop drawings and in accord with ADA requirements.
3. Fill directories with combination of reviewed copy on message strips on blank message strips.
4. Wrap each individual unit with clear polyethylene (see-through) pack and ship by floor in numerical order, tagged sequentially to message schedule.
5. A final copy of the message schedule provided in this bid package is to be provided to the client for their review and approval prior to any fabrication.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

#### A. Verification of conditions:

1. Examine areas to receive signage; notify architect/designer in writing of unacceptable substrate.
2. Beginning work indicates acceptance of substrate. Subsequent modifications to substrate or modules becomes this section's complete responsibility.

### 3.02 INSTALLATION

- A. Contact the architect/designer if there are any questions as to suitability of the installation location or installation surface.
- B. Install signs in locations with mounting types indicated in accord with reviewed shop drawings. Square, plumb and level units.
- C. Install inserts not more than 48 hours prior to Date of Substantial Completion complete with correct copy in place. Conform to ADA requirements for tactile graphics signage.

### 3.03 CLEANING

- A. Clean exposed surfaces using non-abrasive cleaning agents such as soap and water or as recommended by manufacturer not more than 48 hours prior to Date of Substantial Completion in accordance with manufacturer's written cleaning instructions.
- B. Maintain signs according to maintenance instructions as provided by the manufacturer.

### 3.04 SCHEDULES

A. Contractor to coordinate schedule with Owner.

B. Refer to Room Finish Schedule for Signage Requirements.

Set 1: Assembly Spaces/ Offices / Storage / Janitor's Closets/ Mechanical Rooms/ Kitchen  
Room name and room number; Words and numbers must be converted to Grade 2 Braille and applied to the sign.

Set 2: Toilet Rooms  
Room name and number; ADA and sex pictograms. Words and numbers must be converted to Grade 2 Braille and applied to the sign. ADA room signage shall be provided as detailed on drawing A6.11 and the requirements of the New York State Education Department.

Set 3: Stair  
Room name, stair designation, stair pictogram; Words and numbers must be converted to Grade 2 Braille and applied to the sign.

Set 4: Classrooms  
Room name and room number; Words and numbers must be converted to Grade 2 Braille and applied to the sign. Interchangeable teacher name plate insert.

Set 5: Maximum Occupancy Signs  
Maximum occupancy for places of assembly, Maximum Occupancy signage shall be provided as detailed on drawings and per the requirements of the New York State Education Department.

END OF SECTION 101419



## SECTION 104400 – FIRE PROTECTION SPECIALTIES

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. Section Includes:

1. Fire extinguishers.
2. Extinguisher cabinets.
3. Accessories.

##### B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 01 33 00 - Submittal Procedures: For administrative and procedural requirements for processing of submittals during the construction phase.
3. Section 01 77 00 - Closeout Procedures: For administrative and procedural requirements for completion of the Work.

#### 1.02 REFERENCES

##### A. Reference Standards:

1. ASTM International (ASTM):
  - a. ASTM E814-11a, Standard Test Method for Fire Tests of Penetration Firestop Systems.
2. International Code Council (ICC):
  - a. International Building Code (IBC) – 2015 Edition.
3. Intertek Testing Services/Warnock-Hersey International (ITS/WHI)
4. National Fire Protection Association (NFPA):
  - a. NFPA 10-2010, Standard for Portable Fire Extinguishers: For criteria covering installations for Class A, B, C, D, and K hazards as well as the selection, inspection, maintenance, recharging, and testing of portable fire extinguishing equipment.
  - b. NFPA 70-2011, National Electrical Code.
5. Underwriters Laboratories, Inc. (UL)
6. United States Code (USC):
  - a. Americans with Disabilities Act of 1990, as amended by the ADA Amendments Act of 2008: For restrictions relating to cabinet projections in corridors.

#### 1.03 ACTION SUBMITTALS

##### A. Submit in accordance with Section 01 33 00.

1. Product Data:
  - a. Cabinets: Materials description for fire extinguisher cabinets include roughing-in dimensions, details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
  - b. Extinguishers: Materials description for fire extinguishers; include ratings and classifications.
  - c. Installation instructions for each product specified.
2. Shop Drawings:
  - a. Small-scale plans showing locations of fire extinguisher cabinets and individual fire extinguishers.

- b. Schedules showing each type of cabinet and extinguisher to ensure proper fit and function.
  - c. Indicate installation procedures and accessories required for a complete installation.
- 3. Samples:
  - a. Extinguisher Cabinet Door and Trim Finishes: For each type of exposed finish required, prepared on samples of size indicated below:
    - 1) Size: 6 inches (150 mm) square.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.05 QUALITY ASSURANCE

- A. Comply with standards referenced in Article 1.02 - REFERENCES.
- B. Provide fire extinguishers, cabinets and accessories produced by a single manufacturer.
- C. Provide fire extinguishers of type approved by UL, State Fire Marshal's Office, and local regulatory agencies, if any.
- D. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle fire protection specialties and related materials using means and methods that will prevent damage, deterioration, or loss.
  - 1. Deliver components in manufacturer's original packaging, properly labeled for identification.

#### 1.07 WARRANTY

All Fire Protection Products (except fire extinguishers) carry a one year warranty after date of shipment against defects in materials or workmanship. Fire extinguishers carry a longer warranty. We will replace or repair any product found defective within this period. No other warranty expressed or implied is valid. Manufacturer's warranty, terms and conditions apply in all cases. Please see complete [warranty](#) on our website for more details.

### PART 2 - PRODUCTS

#### 2.01 FIRE PROTECTION SPECIALTIES MANUFACTURERS

- A. Acceptable Manufacturers:

JL Industries, Inc., a division of Activar Construction Products Group  
 9702 Newton Av S  
 Bloomington, MN 55431

(800) 554-6077  
 (952) 835-6850  
 (952) 835-2218 (FAX)  
 SALES@ACTIVARCPG.COM  
[www.activarcpg.com](http://www.activarcpg.com)

- B. Substitutions: Manufacturers seeking approval of their products are required to comply with the Owner's Instructions to Bidders, generally contained in the Project Manual.



## 2.02 FIRE EXTINGUISHERS

- A. Contractor is to provide and install Fire Extinguishers and cabinets as noted on plans.
- B. Pressurized Water Type: Extinguisher unit containing water and compressed air; nontoxic.
  - 1. Construction: Butt-welded 304-L stainless steel cylinder with stainless steel discharge lever and fixed carry handle, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin, and UL-labeled chemical engine hose.
  - 2. Effectiveness (Rating): Class A fires.
- C. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
  - 1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
  - 2. Finish: Factory powder-coated; Red.
  - 3. Effectiveness (Rating): Class A, B, and C fires.
- D. Carbon Dioxide Type: Extinguisher unit containing liquid carbon dioxide under pressure; nonconductive.
  - 1. Construction: Lightweight, high pressure, aluminum cylinder with O-ring seal, metal valve, replaceable molded valve stem seal, and pull pin.
  - 2. Finish: Factory powder-coated; Red.
  - 3. Effectiveness (Rating): Class B and C fires.
- E. Regular Dry Chemical Type: Extinguisher unit containing a siliconized dry sodium bicarbonate base; nontoxic.
  - 1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin, and upright squeeze grip.
  - 2. Finish: Factory powder-coated; Red.
  - 3. Effectiveness (Rating): Class B and C fires.
- F. Halotron® Type: Extinguisher unit containing a clean extinguishing agent Halotron® 1 approved by the EPA, accepted and specified by the government, and approved by the FAA for use in airports; nonconductive.
  - 1. Construction: Drawn steel cylinder with steel siphon tube, O-ring seal, power cone discharge system, replaceable valve stem seal, visual pressure gage, pull pin, and upright squeeze grip.
  - 2. Finish: Factory powder-coated; Red.
  - 3. Effectiveness (Rating): Class A, B, and C fires.
- G. Class K Wet Chemical Type: Extinguisher unit containing a low "pH" potassium acetate solution.
  - 1. Construction: Stainless steel cylinder with protective nozzle tip orifice seal and nonmetallic nozzle tip finger guard, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin, and upright squeeze grip.
  - 2. Effectiveness (Rating): Class K fires.
- H. Water Mist Type: Extinguisher unit containing water; nontoxic.
  - 1. Construction: Nonmagnetic cylinder and misting nozzle, O-ring seal, replaceable valve stem seal, visual pressure gage, and pull pin.
  - 2. Finish: Factory powder-coated; White.
  - 3. Effectiveness (Rating): Class A and C fires.

- I. Accessories:
  - 1. Mounting Brackets:
    - a. Standard Brackets: Provide manufacturer's standard steel bracket, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

## 2.03 EXTINGUISHER CABINETS

- A. Cabinet with Acrylic Bubble Door: Clear Vu Series
  - 1. Cabinet Style: Semi-recessed
  - 2. Components:
    - a. Tub (Recessed and Semi-recessed cabinets): Cold-rolled steel.
    - b. Stainless Steel Door and Trim Construction: Flush doors with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
      - 1) Finish: Factory-applied ground and polished finish.
        - a) Standard Finish: #4 directional satin finish.
    - c. Bubble: Acrylic bubble with 2-1/2 inch (63.50 mm) projection.
      - 1) Standard Color: 25 - Clear.
    - d. Trim Style and Depth:
      - 1) Semi-Recessed Cabinet:
        - a) Square Edge: 1-1/2 inch
  - 3. Fire-Rating: Fire-Rated for 1-hour and 2-hour combustible and noncombustible wall systems

## 2.04 SOURCE QUALITY CONTROL

- A. Ship extinguishers to the Project site fully charged, EXCEPT those which contain water as an extinguishing agent, if any.
- B. Obtain Fire Extinguishers and Fire Extinguisher Brackets from same manufacturer to ensure compatibility.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed, and blocking where surface mounted cabinets will be installed.
  - 1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
  - 1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer=s instructions.
3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.

### 3.03 FIELD QUALITY CONTROL

- A. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

### 3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104400



## SECTION 11 40 00 – FOOD SERVICE EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 GENERAL

- A. Raymond/Raymond Associates is herein identified as the Kitchen Consultant.
- B. Custom fabricated equipment must be built by a company continually in business for at least a 5-year period.
- C. Contract documents convey a method of construction for custom fabrication; however this may or may not be the appropriate method based on selected fabricators industry knowledge and standards. It will be the responsibility of the selected fabricator to interpret and apply appropriate methods of construction for full functionality of custom fabrication.

#### 1.03 WORK INCLUDED

- A. Cooperate in every way with other contractors in order that whole installation may result in the highest grade possible.
- B. Only such valves, traps, faucets, shut-offs, reducing pressure valves, relief valves and other specialty items required within equipment and as hereinafter specified, included in this work.
- C. Make all necessary cut-outs and knock-outs where required on equipment to accommodate electrical receptacles, switches or other electrical outlets and equipment, together with such cut-outs as required for passage of gas or plumbing piping, etc.
- D. Stack and remove rubbish waste material, crating, etc., resulting from work and keep the premises clean at all times. Upon completion of the installation, thoroughly and finally clean all equipment ready for use.

#### 1.04 POWER AVAILABLE

- A. Electric Voltage: 120/208/480 volt, 60 cycle, 1 & 3 ph.
- B. Water Pressure: Typical Food Service Equipment range 25 to 90 PSI, if required, pressure reducing valves provided by plumbing contractor.
- C. Water Temperature(s):
  - 1. 110°-120° Fahrenheit max at hand washing sinks, work sinks and preparation sinks.
  - 2. 120°-140° Fahrenheit max at 3-compartment pot sink, dishwashers and hose reel assembly.
  - 3. 110°-120° Fahrenheit max at cooking equipment with faucet assembly.

- D. Gas Pressure: Typical Food Service Equipment range 5" W.C. to 10" W.C., if required, a gas pressure reducing valve at main feed, prior to equipment connection, to be provided by plumbing contractor.

#### 1.05 GENERAL CHARACTERISTICS OF EQUIPMENT

##### A. Electrically Operated

1. Electrically operated equipment: listed by Underwriters Labs., Inc.
2. Motors: up to and including 1/2 h.p., shall be 120/60/1
3. Motors: over 1/2 h.p., 208/60/3, or as otherwise indicated
4. Ranges, food warmers, etc., over 1.5 k.w., 208/60/3, unless otherwise specified
5. Electrically heated equipment, etc., 1.5 k.w. and under, 120/60/1
6. 1 ph. electrical plug-in units with 3 wire cords; 3 wire cap
7. 3 ph. electrical plug-in units with 4 wire cords; 4 wire cap
8. Motor driven equipment: equipped with starting switch
9. Motors: equipped with overload protection
10. Wiring on fixtures, including operating switches and pilots, furnished by Kitchen Equipment Contractor.

- B. Submit in writing to Architect and Food Service Consultant for approval, schedule showing proposed electrical characteristics of each piece of equipment and disconnect means provided.

- C. Punch holes for, and install hood and walk-in cooler/freezer lights and concealed conduits. The interconnection of same, including control switch, wiring, etc., by Electrical Contractor.

#### 1.06 WORK EXCLUDED FROM THIS DIVISION

- A. The following work in conjunction with Food Service Installation, done by others.

##### 1. Electrical Contractor

- a. Make connections to all food service equipment as shown.
- b. Furnish disconnect switches.
- c. Interconnecting of all hood lights and control switches.
- d. Interconnecting of control switches as required on equipment shown, and all other components which come as part of any equipment shown on plan.
- e. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished by Kitchen Equipment Contractor.

##### 2. Plumbing Contractor

- a. Make hot and cold water waste and gas connections to all kitchen equipment shown, furnishing all necessary shut-offs, traps, grease traps,

- line runs, etc., and install all faucets, pot fillers, filters and pressure regulators, furnished by Kitchen Equipment Contractor.
  - b. Interconnecting of any and all other components that come as part of any other equipment shown.
  - c. Provide floor drains and floor sinks where shown and indirect piping to floor drains and floor sinks as indicated on drawings.
  - d. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished by Kitchen Equipment Contractor.
- 3. Ventilation Contractor
  - a. Furnish size, shape and location of vent collars for hood and make connections to these collars. Collars by Kitchen Equipment Contractor.
- 4. General Contractor
  - a. Provide and/or coordinate all work to the floors, walls, and ceiling of the space.
  - b. Provide wall blocking where required and as indicated K.E.C.

#### 1.07 SUBCONTRACTORS

- A. The name and addresses of all Subcontractors furnished to Architect/Owner and Food Service Consultant at time of submitting shop drawings. Selection of Subcontractors must be approved by them; and if in their judgment any fail to prosecute work in strict accordance with drawings and contract, after due notice from Owner or his agent, shall discharge same, but this in no way releases Kitchen Equipment Contractor from his obligations and responsibility under the contract.
- B. Every Subcontractor bound by terms and provisions of the contract so far as applicable to his work. Nothing contained herein shall create any contractual relations between any Subcontractor and Owner.

Note: Kitchen Equipment Contractor fully responsible to Owner for acts and omissions of his Subcontractors.

#### 1.08 SHOP DRAWINGS, ETC.

- A. Immediately upon award of Contract and within 4 weeks, submit to Architect/Owner and Food Service Consultant, 3 sets of drawings for approval. Submit 1/4" scale roughing drawings showing locations of plumbing, and electrical connections with all requirements indicated at point of connection; use of a legend or numbered connection plan will be cause for drawing rejection. Prior to fabrication, Kitchen Equipment Contractor shall submit to Architect for approval 3 sets 1/2" scale shop drawings showing plan, elevations and isometric views covering all items of work. Drawings to show dimensions and details of construction, installation and relations to adjoining and related work where same requires cutting or close fitting. Show reinforcement, anchorage, etc., required for complete installation. After correction and approval of above -- submit 6 sets for record, then afterwards as many additional copies as required by client.
- B. Submit in same manner as above, drawings showing masonry bases, depressed floors, positions of walls, requirements for ceiling hangers, wall blocking, and any and all special information necessary for complete and correct correlation of various trades and satisfactory installation of all equipment shown on drawings.

- C. Manufacturer's names, cuts, descriptive data, analysis of tests, rated capacities and other information necessary for approval of standard manufactured articles and equipment furnished to Architect/Owner and Food Service Consultant for approval before ordering or purchasing. This submission made in same manner as above. All cuts marked with item number, mechanical characteristics, accessories furnished and bound in folders.

#### 1.09 GENERAL

- A. No machine or equipment acceptable from any manufacturer not having had equipment of approximately the same type and design as that specified operating successfully for at least 5 years. Machines installed for test purposes shall not come within the category of successful commercial operation.
- B. Architect and Food Service Consultant privileged to inspect material and fabrication at Kitchen Equipment Contractor's factory at any time.
- C. Before proceeding with shop work, Kitchen Equipment Contractor to verify all measurements at premises. Where required dimensions are not immediately obtainable and delay in waiting for these dimensions would cause work to be seriously delayed, the matter shall be referred to Architect for a decision. In obtaining measurements, Kitchen Equipment Contractor shall consider work requirements of other trades, and equipment designed and fabricated to provide necessary clearance for surrounding and adjoining work.
- D. Kitchen Equipment Contractor responsible for making any and all necessary adjustments to complete his work in a workmanlike manner, as approved by Architect/Owner.
- E. Dimensions as indicated on drawings and specifications are approximate, and are to be adjusted if and where necessary to suit job conditions and field measurements.
- F. Tops of tables, shelves, tops and exterior panels of cabinets, counters, doors, drainboards, etc., to be constructed of a single sheet of metal. Where size of equipment requires more than 1 sheet of metal, sheets butt joined with joints continuously welded full length. No joints less than 18" from an edge or end of a piece of equipment. In addition, all joints shall have battens or stiffeners welded to jointed material, ground smooth and polished.
- G. Appliances of rigid construction free from objectionable vibration and quiet in operation.
- H. Electrical heating elements shall conform to latest standards of National Electrical Manufacturer's Association and Underwriters Labs., Inc., where applicable standards have been set up by such agencies.
- I. Motors of ample power to operate machines for which designated under full load operating conditions without exceeding nameplate ratings. Horsepower requirements on driven equipment determined by manufacturer, based on normal operation of maximum capacity.
- J. Motors drip-proof, splash-proof or totally enclosed type, having two-hour duty cycle and ball bearings (except small timing motors which may have sleeve bearings). All motors shall have windings impregnated to resist moisture. Motors located where adjacent to deposits of dust, lint, etc., totally enclosed type.
- K. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections



within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

#### 1.10 STAINLESS STEEL (S.S.)

- A. Where S.S. is specified, it shall be Type 304, nickel bearing iron alloy, containing approximately 17.0% to 19% chromium, 8% to 10% nickel, not more than 0.2% carbon, and not more than 2.0% of other alloying elements; designed being austenitic (non-magnetic).
- B. S.S. free from scale with all surfaces polished to a high commercial finish. All welding and exposed welds hereinafter specified, must be ground down and polished smooth to a #4 finish so that no evidence of welding will appear. Unexposed welds on underside of counter or tables ground smooth and treated with an acid solution to remove weld discoloration and oxidization and to arrest corrosion.
- C. Undersides of all counters, work tables, sinks, drain boards, etc., after fabrication, to have one (1) heavy coat of sound deadening material applied as allowed by local codes.
- D. Gauges for sheet iron and sheet metal, U.S. Standard.
- E. Rivets, welds, bolts, screws, nuts and washers to be steel except where brass or S.S. is fastened, in which case they shall be brass or S.S., respectively. Where dissimilar metals are fastened, welds, bolts, rivets, screws, nuts and washers, highest grade metal. Spacing and extent of welds, rivets, bolts and screws such as to insure suitable fastening and prevent bulging of metals fastened.

#### 1.11 SANITATION

- A. All custom built equipment constructed in accordance with standard No. 2, 4 & 7 of National Sanitation Foundation Testing Laboratory, manufactured by a company approved by N.S.F. and carry their stamp of approval. Kitchen Equipment Contractor must have "Registered" numbered seal of N.S.F. approval.

#### 1.12 OPERATING INSTRUCTIONS

- A. Kitchen Equipment Contractor shall leave all items of equipment in good, operating condition and furnish the services of a "qualified" competent manufacturer's representative to instruct Owner's employees in proper use and care of equipment. Representative on call for as long a period as is necessary to assure Owner that such instruction is thoroughly understood.
- B. Kitchen Equipment Contractor shall be responsible for scheduling of equipment demonstrations and/or training and shall provide a detailed list of expected dates, times and manufacturer's representative to be present (in attendance) for each piece of equipment.
- C. Kitchen Equipment Contractor or his qualified manufacturer's representative, thereafter, shall make all necessary calls during warranty period.

#### 1.13 SAMPLES

- A. After Award of Contract, when requested, Kitchen Equipment Contractor shall supply Architect with samples of fabricated equipment, such as corner of table with a rolled or inverted "V" edge, corner of dish table, overshef, drawer assembly, table leg with foot and gusset, or as specifically requested.

#### 1.14 GUARANTEE

- A. Kitchen Equipment Contractor shall guarantee, as part of the bid and/or contract, workmanship, material and equipment for a period of 1 year from date of equipment final install and project turnover to Owner, and shall remedy any defect due to faulty workmanship or materials which may appear within guarantee period.
- B. Manufacturer's operation and maintenance manuals on equipment, etc., turned over to the Owner in duplicate, bound in a folder and marked accordingly.

#### 1.15 EQUIPMENT CONSTRUCTION AND STANDARDS

- A. Where initials S.S. are used, they refer to "stainless steel;" C.P. refers to "chrome plated;" N.I.C. refers to "not in contract;" G.I. refers to "galvanized iron;" F.D. refers to "floor drain", and F.S. refers to "floor sink."

#### 1.16 WASTES AND OVERFLOWS

- A. Sinks to have the following waste and overflow assemblies:
  - 1. For 1-1/2" NPT: Component Hardware model D13-7315 or approved equal. Lever handle waste outlet with 1-1/4" overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with crumb cup strainer, 20 gpm max flow rate, stainless steel lever handle, overflow head with stainless steel faceplate and nickel plated cast brass drain body.
  - 2. For 2" NPT: Component Hardware model D13-7415 or approved equal. Lever handle waste outlet with 1-1/4" overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with crumb cup strainer, 20 gpm max flow rate, stainless steel lever handle, overflow head with stainless steel faceplate and nickel plated cast brass drain body.

#### 1.17 WATER INLET LOCATION

- A. Located in all cases above the positive water level to prevent siphoning of liquid into water system. Wherever conditions require water inlet below such level, a suitable type of vacuum breaker shall be placed on fixture and form part of same to prevent such siphoning.
- B. All faucets furnished by Kitchen Equipment Contractor as specified. Traps furnished by Plumbing Contractor.

#### 1.18 PITCH AND DRAINAGE

- A. Wherever a fixture is used with waste or drain outlet, surface shall have distinct pitch towards outlet. Drainboards and tables that contain or adjoin sinks shall have a definite pitch towards sinks. Where necessary, surfaces creased and grooved to give a definite pitch.

#### 1.19 SINKS

- A. #14 gauge S.S. interior corners rounded to 1" radius horizontally and vertically, forming a cove in bottom. All joints butt edged. Sink sizes given, inside measurements.
- B. Bottom of each compartment creased to center and fitted with a rotary drain as described in section 1.16, hereinbefore specified. Waste lever not to protrude beyond body of sink. Sinks to have overflows installed by Kitchen Equipment Contractor.

- C. Overflow to consist of 1-1/2" chrome plated brass strainer plate, fitted in back of each compartment at proper level directly connected to waste outlet with 1-1/2" chrome plated brass pipe.
- D. Back of sink extended integrally approximately 12" above working level, back 2-1/4" on 45° angle towards rear and then flanged down 1" and punched to accommodate faucets.
- E. Front and both ends, unless otherwise specified and shown, finished on top edge, 3" above working level, with 1-1/2" diameter, 180° welded integral roll. Exterior corners rounded to a 2-1/2" radius, all integrally welded.
- F. Sinks and drainboards finished on front and back edges only and left with straight edge on ends, so that drainboards may be welded thereto, forming integral units with top edge of rolled rim curbing formed on one horizontal plane across front to unit though surfaces of drainboards pitched to sinks.
- G. Multiple compartment sinks divided with double wall #14 gauge S.S. partitions, all corners rounded same as corners in sinks, continuously welded in place.
- H. Back, bottom and front of one continuous piece with no overlapping joints or open spaces between compartments.

#### 1.20 SINK BOWL BUILT INTO TABLE TOP

- A. Sink constructed integral with table top #14 gauge S.S. having all interior corners coved vertically and horizontally forming a cove in bottom. To have overflow, lever waste outlet, etc..., as hereinbefore specified for sinks in spec section 1.19.
- B. All joints butt edged and welded, ground and polished, so that no evidence of welding will appear. All sink sizes inside measurements. Table top where shown, punched to receive deck type combination faucets, provided by Kitchen Equipment Contractor.

#### 1.21 FAUCET AND BASKET DRAIN ASSEMBLY

- A. Sinks to have the following faucet assemblies:
  - 1. 3-Compartment Sink, Potwash:
    - a. 1 ea. Component Hardware model KLP53-10L4-AF4 or approved equal. Pre-Rinse assembly with 1.3 gpm flow rate or less, splash/ wall mount, 8" centers, add-on faucet 12" stainless steel tubular swing spout with 4" wrist blade handles, 35-1/2" flexible gooseneck with spray head, stainless steel spring with wall bracket, compression valves, 1/2" NPT female inlets, ADA compliant, low lead and NSF approved. Deck mount assembly model KLP50-10L4-AF4.
    - b. 1 ea. Component Hardware model KLP54-8012-SE4 or approved equal. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, low lead and NSF approved. Deck mount assembly model KL61-8012-SE4.
  - 2. 2-Compartment Sink, Preparation:
    - a. 1 ea. Component Hardware model KLP54-8012-SE4 or approved equal. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout,

compression valves, 1/2" NPT female inlets, ADA compliant, low lead and NSF approved. Deck mount assembly model KL61-8012-SE4.

3. Work Sink (Built-in, Welded-In):

- a. 1 ea. Component Hardware model KLP54-8012-SE4 or approved equal. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, low lead and NSF approved. Deck mount assembly model KL61-8012-SE4.

4. Hand Sink:

- a. 1 ea. Component Hardware model KL45-4002-SE4 or approved equal. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 4" centers, 6" stainless steel swivel gooseneck spout, compression valves, 1/2" NPT female inlets, ADA compliant, low lead and NSF approved. Deck mount assembly model KL41-4002-SE4.

- B. All plumbing fixtures shall be certified CSA, ASME A112.18.1/CSA B125.1, AB1953/HSC 116875, Vermont Bill S152, NSF/ANSI 61 sec 9, annex F and G, NSF/ANSI 372 low lead content, ASTM F2324.

1.22 DRAINBOARDS

- A. #14 gauge S.S. full width of sink carried up approximately 12" at back and where adjacent to wall and finished same as heretofore described for back of sink, and having 3" high curbing at front and ends not adjacent to walls and finished with integral 1-1/2" diameter 180° roll, unless otherwise specified.
- B. Drainboards continuously welded to sinks.
- C. Drainboards 30" long or less shall have 1-1/2" #16 gauge S.S. tubular braces secured at underside near front and welded to S.S. gusset at leg anchor. All others to have legs and cross bracing with full length and width undershelf as specified for tables.

1.23 TABLES WITH S.S. TOPS

- A. Tops of #14 gauge S.S. 1 piece construction with all edges turned down into 2" integral 180° roll with all corners rounded to 2" radius forming a bullnosed corner. Corner welded and polished smooth.
- B. Table tops thoroughly cross braced with 4" x 1" S.S. channel stiffeners #14 gauge welded to underside. All cross braces spaced not over 24" on center.
- C. Table tops adjoining walls or adjacent equipment carried up approximately 6" and returned 1", down 1" at top and ends. Intersections of table top and raised edge coved to 1" radius. Where backsplash is exposed, it shall have finished S.S. back.
- D. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

1.24 LEGS AND CROSSRAILS

- A. 1-5/8" O.D. #14 gauge S.S. tubular-type with S.S. bullet shaped feet having minimum vertical adjustment of 1-1/2" without showing threading or adjusting bolts. Feet fully enclosed on bottom. Adjustment of feet by means of a threaded shank attached to foot and screwed into a properly secured threaded member inside of leg. Construction of leg such that it shall fit over shank of foot so no liquid or other material can work their way into legs or foot.
- B. Tops of legs attached to enclosed conical gussets of heavy gauge S.S. Gussets welded to #14 gauge S.S. 4" x 1" channels to underside on which they appear. Crossrails 1-1/2" O.D. #14 gauge S.S. coped and welded to legs approximately 10" A.F.F. or as specified.

1.25 OVERSHELF - TABLE TYPE

- A. #16 gauge polished S.S. with all edges turned down and finished in a 1-1/2" diameter 180° roll - corners bullnosed, welded 1 piece construction.
- B. Shelves supported by 1" O.D. #14 gauge S.S. tubular uprights, tapered at top and flared at bottom, secured to table top with concealed inner tie rods, bolts and nuts. Uprights spaced approximately 42" on center not to interfere with table top proper. When uprights are located in other areas in addition to each end of table then they shall be cantilevered.

1.26 NOT USED

1.27 UNDERSHELVES

- A. #16 gauge polished S.S. full length and width of table with all edges turned down into 2" wide channel. In way of table legs, shelf notched to fit contour of legs and fitted to same in neat, workmanlike manner to eliminate unsanitary crevices, fully welded, ground and polished.
- B. Undershelves reinforced on underside with welded 4" x 1" longitudinal channels of #14 gauge S.S. where applicable. All signs of welding on shelf surface removed.

1.28 DRAWERS

- A. Of #18 gauge S.S. all interior corners coved to a 1" radius both vertically and horizontally. All welds ground and polished to a uniform finish.
- B. Front of #14 gauge polished S.S. and will extend on both sides of drawer body to conceal slides, corners welded, ground and polished. Space between drawer front and body fully enclosed at bottom, back and both sides by means of a #20 gauge S.S. filler, spot welded to drawer front and body, to provide a fully sealed, vermin-proof enclosure. Drawer front provided with a 5" C.H.G. # P46-1010 S.S. pull handle fastened in place by means of a concealed screws.
- C. Drawer slides of #14 gauge S.S. fitted with 4 case hardened ball bearing rollers. Track attached to drawer is to have upper edge channel shaped to fit contour of roller rim to provide a positive drawer guide and prevent jarring. This drawer track firmly spot-welded to body. Outer track provided with auto stops to lock without the use of tools.
- D. Where specified, drawer provided with removable synthetic carving board. Carving board is to slide into enclosure under drawer made of #14 gauge S.S. and extending across underside of carving board, with both sides turned up and welded to slide assembly. The 2 sides provided with #14 gauge S.S. angles with stops at rear fastened in place 1/8" above

top surface of carving board to provide guide and storage compartment when carving board is not in use. Carving board is to measure approximately 21" x 21" x 1" thick.

- E. Tool drawer 20" x 20" x 5" deep, bread drawer 20" x 20" x 10" deep. All drawers to have 4 pin paracentric keyed-alike built-in locks same as sliding and hinged doors. C.P. where exposed.

#### 1.29 POT AND PAN RACKS AND CEILING HANGERS

- A. Unit 24" wide, of length as shown, of 2" x 1/4" S.S. bar throughout. Outer rail to have fully rounded ends of 1 piece all welded construction. Center rail located 12" below outer rail and fastened to same with V-shaped braces of 2" x 1/4" S.S. bar. All joints continuous welds. V-shaped braces spaced not over 60" on center. Racks fitted with removable sliding type S.S. pot hooks spaced 9" on center.
- B. Unit hung from iron structure, ceiling or slab by 1" O.D. #14 gauge S.S. tubing. It shall be flattened, rounded with ends fully welded and fastened to rack by 3/8" round head screws with cap nuts and lock-washers. Top of tubular ceiling hanger welded to #12 gauge S.S. disc approximately 4" diameter that in turn anchors to joists above. Ceiling hangers over 60" in length to have diagonal sway braces of 1" O.D. S.S.
- C. Proper anchorages, etc., installed in iron structure, ceiling joists or slab by Kitchen Equipment Contractor prior to final finish of ceiling. Top rail of unit 90" A.F.F.

#### 1.30 EXHAUST HOOD

- A. Exhaust Hood material, construction, etc. to be in conformance with IMC section 507.
- B. Dimensions approximately as shown on contract drawings and mounted at 80" A.F.F. to underside of hood. Final dimensions to be determined in field by Kitchen Equipment Contractor.
- C. Proper anchorages, etc..., installed in ceiling joists, slab, etc..., by Kitchen Equipment Contractor prior to final finish of ceiling.
- D. Body of #18 gauge stainless steel front, back and sides; straight as indicated on contract drawings. All joints to be flush welded. Where field joints occur, provide a pair of transverse frames, butted together and securely fastened following contour of hood structure.
- E. Bottom rim of hood attached to channel of #14 gauge STAINLESS STEEL with mitered welded corners and butted field joints. Cross section inside of channel to measure approximately 2-1/2" horizontally, flanged upward tightly against interior lining of hood.
- F. Above dishwashing machine, kettles and steamers or non-grease producing equipment, hood provided with sloped baffle at back arranged at 45° angle of #18 gauge stainless steel. Baffles to have sliding dampers of #16 gauge stainless steel mounted in #14 gauge stainless steel channel tracks. Each damper to have stainless steel handle fastened with concealed bolts.
- G. Above ranges, ovens, fryers, griddles, etc. or grease producing equipment, hood provided with built-in filters at back extending full length and arranged at an angle of 45° easily removable without use of tools. Filters to be approximately 20" x 20" x 2" thick, of STAINLESS STEEL and expanded metal construction or as further indicated on contract drawings. Filters set into #14 gauge STAINLESS STEEL filter frame, bottom of which is

integrally installed with back of hood and grease gutter for easy cleaning. Quantity and size of openings in plenum chamber as indicated in contract documents.

- H. Hood(s) provided with STAINLESS STEEL hanger brackets, welded to top of hood, spaced not more than 36" on center.
- I. Section of hood below ceiling or soffit, enclosed with vertical facing of #18 gauge STAINLESS STEEL. Panels not to exceed 36" in width, easily removable where required, provided with recessed finger grip or similar. Where panels meet at vertical joints flanged inward 1" to form a hairline joint. Channel extended 2" beyond perimeter of hood and provided with concealed full length angle member of 2" x 2" x 3/16" G.I. with clips for bolting to hanger angles, spaced approximately 36" on center. Hanger angles attached to 2" x 2" x 3/16" angle frame fastened to ceiling slab. Panels held in place at ceiling with 2" x 2" x 1/8" STAINLESS STEEL angle trim all around.
- J. Hood(s) provided with recessed or flush vapor-proof LED light fixtures, approximately 12" X 12" style or 48" strip style, pre-mounted by manufacturer. Light fixture with bulb(s), as provided by specified exhaust hood manufacturer, refer to Part 2 Products. All wiring and interconnections by Electrical Contractor.
- K. All exhaust hood controls, switches, etc... to be mounted @ 48" AFF. This is to be the maximum height allowed.
- L. All wiring and interconnections for controls, switches, fans, solenoid, shunt trips, etc... by Electrical Contractor. This includes any requirements to and from remote panels, switches and control packages.
- M. Must be tested and comply with the most current codes (or per local jurisdiction) UL-710, International Mechanical Code (IMC), and NFPA 96.

1.31 NOT USED

1.32 FIRE PROTECTION SYSTEM

- A. The system shall be a pre-engineered cartridge-operated type R-102 system utilizing Liquid Ansulx agent, with a Fixed Nozzle distribution network. It shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96-2008 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27-2002.
- B. System to provide connection to building Fire Alarm System per NFPA 17A; Section 3-2.1.5.
- C. Fire protection remote pull stations mounted @ 48" AFF, located 10 ft. minimum to 20 ft. maximum from exhaust hood(s).
- D. The extinguishing agent shall be a specifically formulated aqueous solution of organic salts contained in a S.S. tank with 3 gallons minimum capacity, and able to withstand test pressure of 330 PSI. A welded S.S. bracket shall be provided for mounting the tank.
- E. The regulator releases mechanism shall be capable of providing sufficient expellant gas to discharge enough agent to meet the minimum nozzle discharge requirements. The mechanism shall have a visual indicator of "fired" condition. This mechanism shall be capable of being operated by fusible link detection, remote manual release and local manual release. The mechanism should be housed in a S.S. enclosure with cover containing identifications thereon.

- F. Each discharge nozzle to be listed with UL approval for placement and size. Each nozzle shall have a rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up. All exposed piping to be chrome plated finish, and there shall be no exposed threads.
- G. Kitchen Equipment Contractor to furnish mechanical (electrical) gas valve, up to 3" in size and coordinate the install/provisions to shut-off all fuel supplies to all cooking appliances beneath Type I exhaust hood upon activation of system. If electrical gas valve is to be utilized, Kitchen Equipment Contractor to furnish reset relay push button.

It is the responsibility of the Plumbing Contractor to install, coordinate and make any provisions necessary for complete operation of gas valve.

It is the responsibility of the Electrical Contractor to furnish and install electrical wiring, relays, etc... and make any provisions necessary for complete operation of gas valve. In addition, Electrical Contractor to furnish and install automatic equipment necessary to shut-off all electric beneath Type I exhaust hood upon activation of system.

- H. Kitchen Equipment Contractor to furnish and install a Class K Fire Extinguisher, dedicated to each room where a Type I exhaust hood is installed.
- I. Upon completion of installation, the installer to perform a wet chemical test or at the time of the test, the authority having jurisdiction may allow the Contractor to use flushing concentrate and water solution. However, whichever is permitted, it must be in compliance with Code. This test shall activate the entire system, except the agent supply tank, which will be substituted by the test tank of like pressure and size. Following a satisfactory test, the original tank shall be replaced. The system shall then be certified to be in working order and all authorities shall be so advised in writing. Provide Owner with copies of all satisfaction/acceptance tests.
- J. The system to be furnished and installed by a factory distributor in accordance with the manufacturer's instructions. This shall include mounting of the system units, manual releases, nozzles, actuating devices, and the running of all pipe and control tubing applicable to the R-102 system. If and when requested, submittal drawings concerning the fire system shall have affixed the seal and signature of a licensed engineer for the State in which they are to be installed. A 1-year service contract and maintenance program to be provided.
- K. Kitchen Equipment Contractor is required to submit a copy of the hood suppression system shop drawing to the local authority having jurisdiction for approval, as well as submission to the Architect. In addition, shop drawings when submitted, must be signed and sealed by an engineer licensed to practice in the State where the system is to be installed.

#### 1.33 DISH TABLES - SOILED AND CLEAN

- A. #14 gauge polished S.S. with exposed edges finished in 3" high curbing with a 1-1/2" diameter, 180° rolled trim at top, corners bullnosed, welded. Where adjacent to wall, top carried up 12" integrally at top and ends. All joints in top welded and free of buckles and weld marks. When applicable, where top (also raised back), adjoins dishwashing machine, same flanged down 1" into machine and secured water tight, backsplash in this area brought forward diagonally to machine to form a baffle. Tops thoroughly cross braced with 4" x 1" channel stiffeners of #14 gauge S.S. and welded to underside. Cross bracing approximately 24" on center, running front to back. All corners in top rounded to 1" radius, vertically and horizontally.

#### 1.34 NOT USED



1.35 NOT USED

1.36 PRE-WASH SINK

- A. Approximately 21" x 21" x 7" deep, of #14 gauge S.S. integrally welded to table top, forming an integral unit with same. Sink bowl identical to that specified for sink built into table top including basket drain assembly with built-in overflow, etc. Sink pitched to a 2" IPS C.P. brass "lever" waste outlet and fitted with a #18 gauge S.S. snug fitting basket approximately 19" x 19" x 6" deep, with continuous perforation and reinforced top edges and 4 sides. Basket of all welded construction mounted on 2" high S.S. feet.
- B. Top of pre-wash sink fitted with S.S. guide for dish racks. Guide of 1-1/2" x 1-1/2" x #12 gauge S.S. angles with ends flared out to facilitate easy movement of racks. Guide welded to cross angles of same material, thus forming a removable frame. Dish table backsplash (unless otherwise specified and shown) in area where pre-wash sink is located, provided with stainless steel pre-rinse unit; includes wall bracket, shortened riser pipe to 16", add on faucet with 12" swing spout, nipples, elbows, backflow preventer mounted on pre rinse unit, mixing faucet with S.S. seats and check valve stems to prevent cross flow, EPAAct 2005 certified.

1.37 NOT USED

1.38 NOT USED

1.39 SERVING COUNTER

- A. Of size and shape as shown. Top of #14 gauge polished S.S. rolled down in a 2" diameter 180° roll on all exposed edges with corners bullnosed, welded. Top secured to counter base by means of concealed S.S. studs, nuts and washers. Angle frame under top sheathed with sound deadening material.
- B. Base constructed with interior framing of 1-1/2" x 1 1/2" x 1/8" galvanized steel angle with all joints welded.
- C. Angle framework concealed on the interior with #18 gauge polished S.S. sheathing. Exterior facing of base cabinet and ends to have sheathing of Plastic Laminate paneling laminated to 3/4" thick solid core, exterior grade marine plywood, panel length not to exceed 36". Color and style of paneling selected by Architect. Each panel of length as indicated, full height of counter and splined hairline joints. Panels and trim secured to interior framing by means of concealed welded studs, nuts and washers. Or constructed of alternate materials as detailed on drawings.
- D. Interior of all available space provided with bottom and intermediate shelf of #16 gauge S.S. turned up approximately 2" at rear and ends, and down 1-1/2", and in 1/2" channel shape at front.
- E. Mounted on masonry base, height as indicated on drawings or 6" high 14 gauge S.S. legs with S.S. removable toe base, where indicated. All openings in top flanged downward approximately 1" around their entire perimeter. Top cut out for and provided with equipment as hereafter specified.
- F. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections

within serving counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

1.40 SOLID SURFACE SERVING COUNTER

A. Of size and shape as shown. Top of minimum 1/2" thick solid surface, silicone mounted to minimum 1/2" thick exterior grade plywood with ten year installation warranty. Solid Surface type, fabricated to comply with Solid Surface commercial specifications. Color and style of solid surface as selected by Architect. Top secured to counter base by means of concealed S.S. studs, nuts and washers. Angle frame under top sheathed with sound deadening material.

B. Base constructed identical to that as hereinbefore described in section 1.39.

1.41 NOT USED

1.42 NOT USED

1.43 NOT USED

1.44 NOT USED

1.45 NOT USED

1.46 NOT USED

1.47 COUNTER AND CABINETS WITH SEMI-ENCLOSED BASE

A. Top of #14 gauge polished S.S. finished 1/2" above working level with 2" diameter 180° roll, bullnosed corners on all exposed sides. Where adjacent to wall, top carried up approximately 6" (or as specified hereinafter and shown) and returned 1" at top and ends towards wall with corners welded forming a continuous unit. Top fastened to cabinet by means of welded and concealed studs.

B. Cabinet below top to have #18 gauge S.S. enclosure. Front stiles of cabinet channel shaped. This channel fully enclosed inside of cabinet. Top reinforced by means of horizontal framework of S.S. 1-1/2" x 1-1/2" x 1/8" angle with cross braces not more than 18" on center. Framework of all welded construction and intermediate shelves in cabinet of #16 gauge S.S. turned up on all sides to eliminate crevices at shelf surface. Front edge of shelf channel shaped. Shelf surface reinforced by means of #16 gauge S.S. channel stiffeners spaced on not more than 24" on center. Mounted on 6" S.S. adjustable legs, or as hereinbefore shown and specified.

1.48 NOT USED

1.49 DOORS

A. Whether sliding or hinged type, not less than 1/2" thick overall, double paneled having 3/8" sound-deadening material between #16 gauge S.S. front and #18 gauge S.S. back, reinforced between panels by wide channels, running height of door and made of same material. Panels jointed with continuous welding. Doors and vent openings to have back panel boxed around vent opening and welded to front panel. Doors dust proof and entire front face without seams or joints.

B. Sliding doors mounted on ball bearing type rollers, sliding in dust proof #14 gauge S.S. tracks overhead, fastened so as to eliminate vibration and jarring when doors are rolled.

Doors fitted with limit stops. Bottom guide of #14 gauge S.S. for doors, open and flat, lining up with lower shelf of cabinet - slots so arranged that crumbs or dirt accumulating in the cabinet will drop to the floor when cabinet is cleaned. Recessed handles solid material, not stamped, of S.S. welded to front panel. Finger grips of ample depth to comfortably pull the door. Doors provided with keyed-alike S.S. faced cylinder locks, built-in flush.

- C. Hinged type doors flush fitting, unless otherwise specified, resting tightly against rabbetted frame. Hinged doors provided with Klein Model #Y-48 (or approved equal) keyed-alike S.S. faced cylinder locks with Model #12230-SM (or approved equal) handles. In case of pair of doors, each individually controlled as outlined and is to close against rubber bumpers.
- D. Outer edges smooth, free from burrs, projections and fins. Excess welded metal removed by precision grinding and polishing.

#### 1.50 REFRIGERATORS AND REFRIGERATION UNITS

- A. Reach-in refrigerators, freezers, and refrigerated units, as shown unless otherwise specified, furnished by Kitchen Equipment Contractor. They shall meet all requirements as set forth for individual item number and complete with self-contained or remote compressors and motors. Cooling coils blower type, unless otherwise called for, provided with initial charge of approved CFC free refrigerant. Plumbing Contractor responsible for extending refrigerator drain line, where required, to spill into adjacent floor drain in approved manner. Extended drain line not less than 3/4" I.D. and C.P. or S.S. tubing.
- B. All refrigerated equipment, refrigerators and freezers, whether walk-in or reach-in, started and adjusted to maintain required temperatures, charged with approved refrigerant as required.
- C. All reach-in refrigerators, freezers, hot food warmers, etc., to have keyed-alike locks. Kitchen Equipment Contractor must request this at time of placing order to avoid correction at a later date at Kitchen Equipment Contractor's expense.
- D. Kitchen Equipment Contractor to provide 1 year's free service for all types of refrigerators and refrigeration equipment. Service to include all compressors, unit coolers, controls, etc., to include adjustments and repairs, irrespective of cause, whether mechanical, operational or manufacturing at no additional cost to Owner. Additionally, five (5) year warranty provided on all compressors, parts only or replacement.

#### 1.51 WALK-IN COOLER AND FREEZER

- A. General Description: To be N.S.F. approved units, of size and manufacturer as indicated on contract drawings, 8'-6" high, unless otherwise specified, completely furnished and assembled unit installed in an approved manner. As indicated on drawing, either installed into a 6-1/2" depressed floor area with flush type door sill and floor finish as shown on contract drawings, or installed directly on floor with interior ramp, and pre-fabricated aluminum floor with heavy duty structural underlayment floor, approximately 5,000 pounds per square feet of load. Where pre-fabricated floor with interior ramp indicated, unit to be finished with "First Choice" vinyl safety flooring provided and installed by Kitchen Equipment Contractor. Where depressed floor indicated, doors, floors, etc. to accommodate concrete-tile finished floors, provided and installed by G.C. after all boxes have been set in place. Walk-in freezers to maintain 0° to "minus" 10° Fahrenheit temperature. Walk-In coolers to maintain 35° to 36° Fahrenheit temperature.
- B. Finishes: Unexposed exterior of each unit to be .040 stucco aluminum finishes. All exposed exterior surfaces to be #20 gauge stucco S.S. finish. Interior, except floor, to be .040 stucco white aluminum finish. Floor as noted hereinbefore in spec section 1.51 A.

C. Insulation:

1. Insulation shall be 4" thick rigid urethane foam, foamed-in-place to bond to inner surfaces of metal pans. Urethane foam to have a thermal conductivity (K factor) of not more than 0.118 BTU/hr./sq. ft. per degrees Fahrenheit/inch, and an overall coefficient of heat transfer (U factor) of not more than .029. The "R" factor shall be 34.
2. (Optional) Prefabricated urethane foam panels shall be supplied with a Class 1 fire hazard classification according to ASTM-E-84 as tested by Factory Mutual System. Panels shall have a flame spread rating of 25 or less and a smoke density of no greater than 450°. Every panel shall bear a certifying Factory Mutual label.
3. \* These ratings are not intended to reflect hazards presented by this or any other material under actual fire conditions.

D. Doors: Each walk-in shall be equipped with one standard 34"/36" x 78" hinged-type, flush mounted entrance door bearing the UL seal of approval, or of size as indicated on drawing. Each door section consists of a heavy reinforced steel "U" channel frame, foamed-in-place to give extra support and rigidity to the frame and to prevent racking, distortion, warping and twisting. Doors to be #20 gauge S.S. interior and exterior. Door and door panel sections to have 1/8" diamond tread kick plates, 36" high on interior and exterior. Walk-in entrance doors shall be equipped with a one-piece perimeter NSF approved PVC accordion type removable gasket. A magnetic core at top and side shall provide positive seal. An adjustable wiper gasket shall be mounted along the bottom edge of door. Door frames shall be provided with an LED light fixture, pilot light and switch assembly, and concealed wiring. Provide #12 gauge reinforced S.S. threshold and heater wire around the full perimeter (freezer door only). All doors hinged as shown, each with heated 14" x 24" "vision" panel.

E. Standard Hardware: Shall be break-a-way type with cylinder lock and inside safety release handle so door can be opened from the inside even if locked. All latches designed for locking with keyed-alike locks. A positive action hydraulic door closer shall be included to insure gentle closing action of door and insure a positive seal. Hinges shall be cam-lift, self-closing, spring assist with door lift-off capability. Hinges shall be high-pressure zinc die cast with highly polished chrome finish, three per door.

F. Filler Panels: The "exposed" open area of unit at left, right and top at front and sides neatly trimmed with #20 gauge stucco S.S. filler panels to close space between wall and ceiling. Filler panels between top of walk-in box and finished ceiling not to exceed 12" in height. Filler panels equal to exterior of unit. Top panels to be equipped with louvered sections not less than 40% of total square footage of panel (when compressor units are top-mounted).

G. Wall Protection: Two rows of #16 gauge S.S. hat shaped rub rails with concealed fasteners; to be provided and installed at all exposed exterior walls. Top of rub rail to align with top of diamond tread kick plate on door and bottom rub rail to be 10" A.F.F. When corners are exposed, provide 6" x 6" x 60" #12 gauge S.S. corner guard.

H. Lights: Walk-In boxes to be provided with 48" LED light fixtures, quantity as shown on plan. The walk-in cooler and freezer to have LED type vapor-proof light with concealed wiring, etc., and toggle switch with pilot light mounted on exterior. Kitchen Equipment Contractor to provide bulbs. It is the responsibility of the Kitchen Equipment Contractor to install light fixtures, provide penetrations in ceiling panels, and seal the penetrations after Electrical Contractor has completed wiring.

- I. Sealants: Kitchen Equipment Contractor shall seal all lines, conduits, tubing, wiring, etc., passing through walls and ceiling of walk-in units with high grade caulking compound, then install S.S. escutcheons where required.
- J. Alarm System: Each compartment shall be protected by Modularm 75LC system with recessed in panel controls. System provided with wireless communicator, mounted at walk-in units, for connection to building network. System shall provide digital readout of ambient compartment temperature(s). The system shall be located in an area as indicated on the contract documents. It shall require 120/60/1 electrical connection through suitable 1/2" conduit. CAT5 cable connection for activation of remote notification equipment will be provided as part of the alarm system. CAT5 cabling provided and installed by General Contractor. Furnish and install identification labels for operating temperatures as required.
- K. Ceiling Support: When split ceilings are required due to ceiling panel span, these ceilings are to be supported by a self-support ceiling structure. The walk-in manufacturer is to provide the ceiling hanger brackets, the steel channels and the bearing steel channels. A detail must be provided on the manufacturer's submittal drawing. Note: When longer spans are required that exceed self-support capability then suspended ceilings are to be provided with manufacturer's detail.
- L. Flat Membrane Weather-Proof Roof: Shall be supplied for field installation on top of each walk-in that is located outdoors. Membranes to be fabricated from low-shrink polyester fabric coated with a permanent thermoplastic alloy and have a minimum thickness of 35 mil. Membrane shall be fire retardant, resistant to ultra-violet rays and micro-organisms. Membrane to be white in color to reflect maximum heat load from the sun. Fasteners and trim shall be provided to secure the membrane to the ceiling panels and in cases where walk-in is installed against a building; the membrane roof material will be flashed up the building walls by the equipment installation contractor. The manufacturer's detail must be provided on the submittal drawing.
- M. Compressors and Evaporators: Cooler unit, model as indicated on drawings; room air drawn through coil and discharged parallel to ceiling. The coil casing is to be aluminum with a removable drain pan. Drain line from evaporator coil to floor drain as indicated on contract drawings, attached to interior of box with clamps and installed in good, approved, workmanlike manner by Plumbing Contractor. Compressor of the hermetic and/or scroll type, with suction gas cooled motor, designed for operation with approved refrigerant. Unit complete with liquid line drier, shut-off valves, vibration isolators, heat exchanger, dual pressure control and water regulating valve (for water-cooled systems), electrical panel with circuit breaker and magnetic starter. All components and accessories in control box that pertains to the compressor unit only should be factory wired and piped.

For outdoor systems a weather-proof housing, thermostatically controlled crank case heater and low ambient controls for -20F conditions shall be provided.

Note: Electrical Contractor to provide and install fused disconnect switch where required, as well as conduit and wiring from same to terminals in compressor unit control panel. Also, interconnect conduit and wiring from compressor unit control panel to unit cooler junction box inside walk-in units.

Freezer Unit, model as indicated on drawing, to be electric defrost. The coil casing is to be aluminum with a removable drain pan. Electric heating elements and drain pan heaters. Unit shall include control kit for time initiated temperature terminated defrost plus automatic fan delay. Heat interchanger included. Drain line from evaporator coil to floor drain as indicated on contract drawings, attached to interior of box with clamps and painted to match interior finish; and installed in good, approved, workmanlike manner by Plumbing Contractor. Kitchen Equipment Contractor to install adequate amount of wrap-around,

electric heater tape to assure defrosting of drain line, cable lapped not over 1" spacing. Provide electrical heat tracing (type 3), self regulating in temperature, run in parallel, to be designed with a maximum temperature that cannot be surpassed, certified by the manufacturer's representative that the heat trace has been installed and tested in accordance to the manufacturer's specifications. Heater tape connected to electric by Electrical Contractor. After installation and before and after installing the thermal insulation, subject heat to testing using a 2500 VDC megger. Minimum insulation resistance should be 20 megohms regardless of length. The installer shall test for both heating cable bus wires to verify the connection of any splices or tees.

Equipment shall have BTU/hr capacity as indicated on drawing and maintain room temperature of 35° to 36° Fahrenheit, where refrigerator is specified, and 0° to "minus" 10° Fahrenheit, where freezer is specified.

Refrigerant piping to be hard seamless copper tubing, by KEC. Refrigerant lines installed and covered with not less than 1" thick flexible foam plastic insulation applied in accordance with the manufacturer's recommendations. Refrigeration lines to run from compressor location where shown, above the walk-in units. All lines to be tested free from leaks prior to finish of insulated lines. Condensates drain lines outside of walk-in boxes, similarly insulated with 1/2" insulation, by KEC. Each system shall have suction line filters and vibration eliminators field installed.

Thermostatic expansion valves properly sized to handle evaporator loads. Liquid lines shall have moisture indicating sight glass, drier, and shut-off valve field installed.

The temperature in each walk-in box controlled by means of a thermostat wired to actuate a solenoid valve in the liquid lines with the compressor operation controlled by the low pressure cut-out switch. Thermostats and low pressure controls adjusted to maintain room temperatures specified. Each system cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a minimum period of 5 hours. The vacuum pump used capable of developing a vacuum of 50 microns with its valve in a closed position. The required operating charge of refrigerant and oil shall then be added and each system tested for performance. All refrigerant lines sized for 1 lb. maximum pressure drop.

It is the purpose of the specification to provide a satisfactory refrigeration cycle, therefore, Kitchen Equipment Contractor must include the competent labor and qualified material to provide the owner with an efficient system.

- N. Mounting Methods: Compressors, when mounted on building roof, to be provided with adequate dunnage/ curbing by Kitchen Equipment Contractor. Dunnage/ curbing installed by G.C. or roofing contractor. Architect to specify dunnage/ curbing details.

Compressors, when mounted on ceiling of walk-in, to be provided with adequate air circulation, service, access, and vibration isolation.

## 1.52 MILLWORK EQUIPMENT

- A. General Description: Woodwork to be minimum 3/4" marine grade plywood throughout. Woodwork counters shall be constructed to support the full weight of operating appliances without any deflection of the counter top. Where cut-outs are required in counter tops, appropriate framing needs to be provided around the cut-out to fully support the top in level position.

All miter joints shall be tight with no gaps or open spaces. Filling of miter joints with crack filler prior to finishing is not acceptable. Loose joints shall be hairline, flat, in single plane,

with no exposed screws, nails or other fasteners. All dimensions, reveals and joints shall be held exact.

All fixtures shall be assembled in single and complete units as the dimensions will permit shipment to and installation at the building. Large pieces requiring sections construction shall have their parts accurately fitted and aligned with each other, and provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts or suitable means of concealed fastening, as required to render the work of substantial, rigid and permanently secured in proper position.

Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work, and due allowance made wherever possible for such shrinkage as may develop after installation. Single and sectional units shall be provided with adequate cleating, blocking, crating and other forms of protection as required to prevent damage, soiling and deterioration during transit, delivery, storage and handling.

Framing and blocking members shall be assembled with bolted and screwed connection and should be secured to the structural backing with cinch, expansion screws or toggle bolts, as required; spaced and installed to ensure ample strength and rigidity. Rails and stiles shall be mortised and tenoned, work neatly mitered and membered, all butt joints made flush and smooth, and all permanent joints made up with water resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All face screws or nails that are necessary shall be countersunk and plastic wood or wood plugs used to cover head and the plug neatly touched up. The heads of all screws used in any assembly shall be countersunk below the surface.

- B. Joints: Mortise and tenon, spline, dowel and/or pin block and glue work to avoid use of nails wherever practical. Make butt joints with an approved device of prevention of separation of members. Blind nail and conceal.
- C. Plastic Laminate (HDPL): Plastic laminate shall be bonded to all exposed surfaces with contact cement fast bond #30, as manufactured by 3-M Products Company, or equal, to minimum 3/4" fir faced plywood applied under high pressure. Reject plastic laminate or plastic backing shall be used to prevent warping, unless otherwise specified. All edges shall be carefully sanded to smooth finish, removing burns, nicks and cut marks.
  - 1. Plastic laminate joints shall be finished without wavy and unsightly joints. Joints need not be mitered except if specified. Hand sand edges to a slight chamfer.
- D. Doors, Hinged: Hinged doors shall be fabricated of 3/4" thick plywood with plywood full perimeter edging with plastic laminate on face and self-edging on exposed sides. Door hinges, pulls and catches shall be supplied and installed as detailed. All doors to have minimum of 3 concealed, heavy duty, European hinges per section.
  - 1. Provide S.S. channel trim on the perimeter of the door to guard plastic laminate from chipping.
- E. Doors, Sliding: Sliding doors shall be fabricated of solid core plywood with hardwood edges and constructed similar to hinged doors. Doors shall be mounted on E-Z Glides track. Doors shall be removable without the use of tools. Rubber stops shall be provided concealed in end stile or mullion.
- F. Doors, Tambour Sliding: Tambour sliding doors shall be fabricated of individual hardwood slats, 3/8" by 3/4" round on 2 edges and glued to 20 ounce duck canvas or reject elastic vinyl plastic or equal and shall be provided with hardwood end stile with integral door pull.

Track shall be lined with laminated plastic or equally smooth surface and guides at top and bottom shall be fabricated hardwood. Provide lock-pin for sliding doors.

G. Access Panels/Louver Panels:

1. Access Panels: Shall be fabricated of 3/4" thick marine grade plywood and shall be fabricated to be removable for access. Each access panel shall be provided with 2 magnetic catches at top and (2) 3/16" positioning pins at bottom (unless otherwise specified or detailed on drawings).
2. Louvered Panels: Are required in woodwork at all locations where proper ventilation is necessary for the efficient performance and operation (exhaust and/or supply) of the food service equipment compressor.

Types (when specified):

- a. Louvered panel spaced to conceal equipment yet provide adequate ventilation.
- b. Kitchen Equipment Contractor to coordinate size, quantity and location of louvered opening for sufficient ventilation of food service equipment. Refer to drawing details for cut-outs and spacing.

3. Unless otherwise directed, panels shall be powder coated to match laminate selection.

H. Louvered Doors: Must have concealed hardware to resemble access panels. Doors to have nylon roller friction type heavy duty catch and heavy duty concealed S.S. adjustable hinge.

1. Plastic laminate fronts: provide kiln dried pine shutter type slats. Wood to be free of knots with smooth grain, epoxy painted to match laminate selection. No raw wood surfaces will be acceptable. Paint or laminate as needed between slats.
2. Slats to be fixed, positioned to conceal equipment from sight.
3. Provide black color screening/mesh on rear of door with protective edges to prevent tearing.

I. Drawers: Drawers shall have dovetail construction, well glued and blocked. Fronts shall be not less than 3/4" thick marine grade plywood. Sides and back shall be 1/2" thick fabricated of Birch, Maple or Sycamore except where extension slides are used, in which case the side shall be 5/8" thick. Bottom shall be milled into fronts and sides. Drawers shall be provided with suitable stops. Provide pulls as detailed or specified.

1. The inside surfaces of all drawers shall receive one coat of Penetrating Primer and one coat of glass lacquer.

J. Painted Finishes: Painted finishes shall have exposed surfaces free from defects and blemishes that would show after being finished, regardless of grade specific. All surfaces specified to receive paint or enamel finish shall receive one crosscoat of lacquer type undercoat. The undercoat shall be of appreciable different color than that of the finish coat, and of proper ground color with relation to the finish coat. After the undercoat has been thoroughly dried, surfaces shall be sanded smooth and two coats of enamel shall be applied. Back painting shall be provided for all cabinet and woodwork prior to installation.



- K. Interior and Wall Shelves: Cabinet interiors and wall shelves shall be laminated as specified under Section C, Plastic Laminate.
- L. Granite Tops:
1. Size, shape and installed where shown on drawings. These are fabricated items and are to be constructed as per manufacturer's requirements and as further detailed on contract drawings.
  2. Color and finish shall be selected by the Architect, and physical properties shall confirm to manufacturer's standard specifications for foodservice application. The material shall be homogenous; and not of a composite construction.
  3. Granite shall be 3/4" thick with 1-1/4" face for counter tops unless otherwise specified.
  4. Angle frame under top sheathed with sound deadening material.
  5. General installed to conform to manufacturers standard details in order to maintain product warranty, i.e. cut outs for drop-in equipment.
- M. Solid Surface:
1. Size, shape and installed where shown on drawings. These are fabricated items and are to be constructed as per manufacturer's requirements and as further detailed on contract drawings.
  2. Color and finish shall be selected by the Architect, and physical properties shall confirm to manufacturer's standard specifications for foodservice application. The material shall be homogenous; and not of a composite construction.
  3. Solid Surface to be minimum 1/2" thick silicone mounted to 3/4" thick grade plywood if required as per manufacturer's recommendations.
  4. Top secured to counter construction by means of concealed S.S. studs, nuts and washers.
  5. Angle frame under top sheathed with sound deadening material.
  6. General installed to conform to manufacturers standard details in order to maintain product warranty, i.e. cut outs for drop-in equipment.

## PART 2 – PRODUCTS

ITEM #1 SPARE NUMBER

ITEM #2 BIN, ICE – QTY. AS PER PLAN & SCHEDULE

ITV Ice Makers Model BIN S-500. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. Ice scoop holder, stainless steel
- 1 ea. Ice shovel/scoop, stainless steel

Or as manufactured by Hoshizaki or Manitowoc.

ITEM #3 ICE CUBE MACHINE, AIR COOLED – QTY. AS PER PLAN & SCHEDULE

ITV Ice Makers Model SPIKA MS 500 A1F. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Mounted on top of Item #2, Ice Bin
- 1 ea. Self-contained refrigeration
- Cold water connection piped from Filter System, Item #4

Or as manufactured by Hoshizaki or Manitowoc.

ITEM #4 FILTER SYSTEM FOR ITEM #3 – QTY. AS PER PLAN & SCHEDULE

ITV Ice Makers Model CS-102-K. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- For use with Item #3, Ice Cube Machine
- 1 ea. Set of replacement filters
- Wall backing by General Contractor

Or as manufactured by Hoshizaki or Manitowoc.

ITEM #5 STORAGE SHELVING, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model QPF-1836E-GL. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 4 ea. 18" x 36" Shelves with removable, vented inserts
- 4 ea. 64" High uprights
- Mounted on heavy-duty casters, front two with brakes

Or as manufactured by Focus or Metro.

ITEM #6 WALK-IN COOLER – QTY. AS PER PLAN & SCHEDULE

Norlake Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Walk-in Cooler Height: 8'-7" AFF
- Exterior finish: Stucco stainless steel where exposed, 20 Gauge
- Pre-formed panels: 4" Thick, polyurethane insulation
- 1-1/2" Vinyl screed application, appropriate floor finish by General Contractor
- Interior floor finish: Continuation of kitchen flooring material, as selected by Architect
- Interior / Exterior diamond tread kick plate at door section, foamed in place
- 1 ea. 36" x 78" Door with vision panel
- 1 ea. Flush mount temperature alarm with wireless communicator system, Modularm 75LC
- 1 ea. Evaporator coil limit switch, mounted in interior door frame

- 1 ea. Removable louvered trim panels to ceiling, accessible

Or as manufactured by TAFCO or American Panel.

ITEM #7 SPARE NUMBER

ITEM #8 REFRIGERATION TO ITEM #6 – QTY. AS PER PLAN & SCHEDULE

Norlake Model NASJ150RL3 with WL6A094SDAS. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/3, Hardwired, compressor unit
- Electrical: 120/1, Hardwired, evaporator coil
- Refrigeration: R-449A
- Refrigerant line maximum run distance, 100 feet
- 1 ea. Evaporator coils mounted within walk-in box, suspended from ceiling
- 1 ea. Compressor units mounted on building roof
- 1 ea. Dunnage rack, rails or curb for compressor unit
- 1 ea. Weatherproof cowl
- 1 ea. Winterized controls

Or as manufactured by TAFCO or American Panel.

ITEM #9 STORAGE SHELVING, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model QPF-1836E-GL. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 4 ea. 18" x 36" Shelves with removable, vented inserts
- 4 ea. 64" High uprights
- Mounted on heavy-duty casters, front two with brakes

Or as manufactured by Focus or Metro.

ITEM #10 WALK-IN FREEZER – QTY. AS PER PLAN & SCHEDULE

Norlake Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Walk-in Cooler Height: 8'-7" AFF
- Exterior finish: Stucco stainless steel where exposed, 20 Gauge
- Pre-formed panels: 4" Thick, polyurethane insulation
- Pre-formed floor panel: 4" Thick, polyurethane insulation with integral 3/4" marine grade plywood
- Interior floor finish: Fully welded vinyl safety flooring
- Interior / Exterior diamond tread kick plate at door section, foamed in place
- 1 ea. Interior ramp
- 1 ea. 36" x 78" Door with vision panel

- 1 ea. Flush mount temperature alarm with wireless communicator system, Modularm 75LC
- 1 ea. Evaporator coil limit switch, mounted in interior door frame
- 1 ea. Removable louvered trim panels to ceiling, accessible

Or as manufactured by TAFCO or American Panel.

**ITEM #11 REFRIGERATION TO ITEM #10 – QTY. AS PER PLAN & SCHEDULE**

Norlake Model LASJ150RL3 with WL6E049DDAS. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/3, Hardwired, compressor unit
- Electrical: 208/1, Hardwired, evaporator coil
- Refrigeration: R-449A
- Refrigerant line maximum run distance, 100 feet
- 1 ea. Evaporator coils mounted within walk-in box, suspended from ceiling
- 1 ea. Compressor units mounted on building roof
- 1 ea. Dunnage rack, rails or curb for compressor unit
- 1 ea. Weatherproof cowl
- 1 ea. Winterized controls

Or as manufactured by TAFCO or American Panel.

**ITEM #12 SAFETY FLOORING, FULLY WELDED – QTY. AS PER PLAN & SCHEDULE**

High Performance Floors Model Protect-All. Unit to be installed where shown on drawings. Flooring to be applied throughout walk-in boxes, including interior ramp, as detailed on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Sheet Material: 5' x 8' Dimensions, 1/4" thick minimum
- Color Selection: Dark Gray
- Finish Selection: Top Surface, Stipple
- Aluminum Edge Flashing: Cove cap mechanically fastened to wall over top of wall board
- Proper bonding agent to adhere to smooth aluminum
- Seams to be heat welded
- Stainless steel Corner Edge Guards mechanically fastened on all outside corners
- Ten year warranty

Or as manufactured by Titan or Altro Stronghold 30.

**ITEM #13 STORAGE SHELVEING, PORTABLE – QTY. AS PER PLAN & SCHEDULE**

Eagle Group/Metal Masters Model QPF-1860E-GL. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 4 ea. 18" x 60" Shelves with removable, vented inserts
- 4 ea. 64" High uprights

- Mounted on heavy-duty casters, front two with brakes

Or as manufactured by Focus or Metro.

ITEM #14 SPARE NUMBER

ITEM #15 DRYING RACK, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model QDR-2448E-GL.

- 4 ea. 24" x 48" Shelves with removable, vented inserts
- 4 ea. 74" High uprights
- 2 ea. Tray drying rack, full shelf
- 1 ea. Drop-in tray drying rack, full shelf
- 1 ea. 24" x 48" Bottom shelf with removable, solid inserts
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Focus or Metro.

ITEM #16 DISHTABLE, STRAIGHT – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- Stainless steel tubular crossrails, side / rear

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #17 RACK SHELF, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Capacity: (3) 20" x 20" Racks
- Mounting height: 56" above finished floor
- 1 ea. Drip tube, 1/2" diameter, verify left/right
- Wall backing by General Contractor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #18 WAREWASHER, DOOR TYPE, VENTLESS – QTY. AS PER PLAN & SCHEDULE

Jackson WWS Model TEMPSTAR HH-E. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/3, Hardwired
- Verify direction of operation
- 1 ea. Single point electrical connection
- 1 ea. Pressure regulator
- 3 ea. Sets of peg racks

- 3 ea. Sets of combination racks
- 3 ea. Vollrath Traex sheet pan racks, TR23
- 1 ea. Built-in hot water booster, 70° rise
- 1 ea. Detergent/rinse aid pumps, built-in
- 1 ea. Water hammer arrestor kit
- 1 ea. Drain Quench System
- 1 ea. Ventless exhaust type
- 1 ea. Tall chamber
- Flanged feet bolted to floor

Or as manufactured by Champion or Hobart.

ITEM #19 3-COMPARTMENT SINK, POTWASH – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 3 ea. Built-in work sinks, 28" L x 24" W x 14" D
- 3 ea. Waste valve with lever
- 3 ea. Tail piece
- 3 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout add-on faucet and wrist action handles, 3/4" connections
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 3/4" connections
- 1 ea. Stainless steel common bowl skirt
- Flanged feet bolted to floor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #20 S.S. RACK GUIDE, REMOVABLE – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. Removable rack guide to fit over sink, Stainless Steel, 12 Gauge
- 1 ea. Integral bracket, undercounter, to hold when not in use

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #21 SPARE NUMBER

ITEM #22 STORAGE SYSTEM, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model WAL-STOR. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting Height: 50" above finished floor
- 2 ea. Wall grid/mat, WM1860-E, stacked

- 1 ea. Wall uprights, vertical, PR45VU-E
- 2 ea. Shelf, 1448-E
- 2 ea. Shelf Brackets, PR14B-E
- 1 ea. Grid Shelf, 1436WGS-E
- 2 ea. Baskets, WB-E
- 12 ea. Utility Hooks, UH-E
- 1 ea. Epoxy coated finish, entire wall system
- Wall backing by General Contractor

Or as manufactured by Focus or Metro.

ITEM #23 SINK, HAND WITH SOAP DISPENSER – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model HSA-10-FDPS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. Soap dispenser
- 1 ea. Towel dispenser
- 1 ea. Gooseneck faucet model 303987 with wrist action handles, 1/2" connections
- 1 ea. Emergency Eye Wash Unit, 326272
- Wall backing by General Contractor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #24 FILTER SYSTEM FOR ITEM #25 – QTY. AS PER PLAN & SCHEDULE

Rational Model 1900.1150US. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- For use with Item #25, Combi Oven-Steamer
- 1 ea. Set of replacement filters
- Wall backing by General Contractor

Or as manufactured by Angelo Po or Alto-Shaam.

ITEM #25 OVEN-STEAMER, COMBI, GAS – QTY. AS PER PLAN & SCHEDULE

Rational Model B128206.19E. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: (2)208/1, NEMA 6-15P
- Gas: 1" Connection, 152 MBtuh
- Capacity: (10) 18" x 26" Pans or (20) 12" x 20" Pans
- 1 ea. Right hinged doors
- 1 ea. Safety door lock
- 2 ea. iCookingControl with 7 modes
- 1 ea. Core temp probe with 6 point measurement
- 1 ea. Hand shower with automatic retracting system
- 5 ea. Grid shelves
- 1 ea. USB interface
- 1 ea. Control panel protection
- 1 ea. Cool down function
- 1 ea. 5-Speed fan, programmable

- 1 ea. Washing system
- 1 ea. Descaler system
- 1 ea. Chef Assistance Program
- 1 ea. RCI Rational Certified Installation
- 1 ea. Installation Kit for gas units
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- 1 ea. Two year parts warranty
- 1 ea. Two year labor warranty
- 1 ea. Mobile Stand, 60.30.331
- Cold water connection piped from Filter System, Item #24

Or as manufactured by Angelo Po or Alto-Shaam.

ITEM #26 OVEN, CONVECTION, GAS – QTY. AS PER PLAN & SCHEDULE

Garland Model MCO-GS-20-S. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: (2)120/1, NEMA 5-15P
- Gas: 1" Rear Connection, 120 MBtuh
- Manifold gas line for double unit
- 1 ea. Pressure regulator
- 1 ea. Stainless steel exterior bottom
- 1 ea. Stainless steel back enclosure
- 1 ea. Extra oven racks
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Southbend or Vulcan.

ITEM #27 RANGE, HEAVY DUTY, GAS – QTY. AS PER PLAN & SCHEDULE

Garland Model MST44R-E. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Gas: 3/4" Rear Connection, 180 MBtuh
- 1 ea. Pressure regulator
- 1 ea. Battery/electronic spark ignition
- 1 ea. 24" High stainless steel riser with 12" W x 34" L tubular overshef
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Southbend or Vulcan.

ITEM #28 SPARE NUMBER

ITEM #29 STEAMER, ATMOSPHERIC – QTY. AS PER PLAN & SCHEDULE

Accutemp Model N612016060 DBL. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:



- Electrical: (2)120/1, NEMA 5-15P
- Gas: 1/2" Rear Connection, 120 MBtuh
- Capacity: (6) 12" x 20" Pans per compartment
- Verify door hinging
- 1 ea. Pressure regulator
- 1 ea. Manifold gas line for double unit
- 1 ea. Double unit, stacked
- 1 ea. Digital controls
- 1 ea. Stainless steel stand with casters, SNH-21-01
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- 1 ea. Filtration system free design

Or as manufactured by Cleveland Range or Groen.

ITEM #30 S.S. WALL PANEL(S) – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Stainless steel panels, evenly sized, 20 Gauge
- Installed from top of coved base to underside of hood, entire length
- Hairline joints sealed with S.S. trim strips
- Secured to wall with heat resistant mastic

It is the responsibility of the Kitchen Equipment Contractor to coordinate and make all appropriate cut-outs in paneling based on utility requirements in this location and apply appropriate stainless steel trim strips, caps, gussets, etc...

Or as manufactured by Caddy or Accurex.

ITEM #31 EXHAUST HOOD, TYPE I – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Construction: 100% 304 stainless steel
- Filters: Stainless steel caprate solo with hook
- Insulation: Integral air / insulation barriers at perimeter and top, 0" clearance to combustibles
- Structural front panel, insulated
- Wall / Island canopy hood, length / size as per contract documents
- 1 ea. Front perforated supply plenum (PSP) with built-in 3" back standoff
- Insulation for PSP housing, as required
- 5 ea. LED lights with bulbs
- Stainless steel field wrap, approximately 18" high on all exposed sides
- Adjustable exhaust air volume control damper
- Hood Control Panel Package:
  - EMSplus11 modulating energy management system with smart controls

- VFDs
- Duct Temperature Sensors in all risers
- Room Temperature Sensor
- Configurable through Touch Screen Interface
- EMS Duct Thermostat
- INVERTER DUTY THREE PHASE MOTORS REQUIRED

Or as manufactured by Caddy or Accurex.

ITEM #32 SUPPLY PLENUM, MAKE-UP – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #31, Exhaust Hood

Or as manufactured by Caddy or Accurex.

ITEM #33 EXHAUST HOOD, CONTROL PANEL – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #31, Exhaust Hood

Or as manufactured by Caddy or Accurex.

ITEM #34 FIRE PROTECTION SYSTEM, BUILT-IN – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model UL-300 (R-102). Unit to be installed where shown on drawing in strict accordance to that described in General Specifications. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Provide connection to building Fire Alarm System
- 1 ea. Mechanical Gas valve, up to 3", size to be verified
  - Provide add/ alternate for electric gas valve
- 1 ea. Reset Relay Push Button
  - Only required with use of electric gas valve
- Included as part of Item #31
- For the protection of equipment beneath Exhaust Hood, Item #31

Or as manufactured by Caddy or Accurex.

ITEM #35 SPARE NUMBER

ITEM #36 WORK TABLE W/ SINK – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15R
- 2 ea. GFCI duplex receptacles mounted in splash, S.S. cover plates

- Counter Top Material: Stainless Steel, 14 Gauge
- 1 ea. Built-in work sink, 20" L x 16" W x 12" D each
- 1 ea. S.S. Removable sink bowl cover
  - Stainless steel, 14 Gauge
  - Finger holes, lift-off
  - Flush inlay with work sink/top
  - Integral bracket, under counter, to hold when not in use
- 1 ea. Waste valve with lever
- 1 ea. Tail piece
- 1 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- 1 ea. Work drawer assembly with removable cutting board
- Stainless steel undershelf, removable
- Flanged feet bolted to floor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #37      OVERSHELF, SPLASH MNTD. – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting height: 56" above finished floor
- Posts support bracket thru splash, welded to frame

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #38      POT RACK, CEILING MNTD. – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting height: 80" above finished floor to underside
- 50 ea. Stainless steel pot-hooks

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #39      CABINET, HEATED, PASS-THRU – QTY. AS PER PLAN & SCHEDULE

True Mfg. Model STR1HPT-2HS-2HS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, NEMA 6-15P
- Verify door hinging
- 4 ea. Stainless steel half doors with locks, pass-thru model
- 1 ea. Digital temperature control system
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- Adjustable universal pan slides 1-1/2" O.C. to hold 18" x 26" or 12" x 20" pans, top and bottom section

- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or Beverage Air.

ITEM #40 WORK COUNTER W/ SINK – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15R
- Counter Top Material: Stainless Steel, 14 Gauge
- 2 ea. GFCI duplex receptacles mounted in splash, S.S. cover plates
- 1 ea. Built-in work sink, 20" L x 16" W x 12" D
- 1 ea. S.S. Removable sink bowl cover
  - Stainless steel, 14 Gauge
  - Finger holes, lift-off
  - Flush inlay with work sink/top
  - Integral bracket, under counter, to hold when not in use
- 1 ea. Waste valve with lever
- 1 ea. Tail piece
- 1 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Cabinet/Door to be flush frame design
- Stainless steel integrated handles, horizontal orientation
- Cylinder locks, keyed alike, as required
- Intermediate stainless steel solid shelves, adjustable
- Flanged feet bolted to floor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #41 OVERSHELF, SPLASH MNTD. – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting height: 56" above finished floor
- Posts support bracket thru splash, welded to frame

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #42 SPARE NUMBER

ITEM #43 TRASH RECEPTACLE, SLIM JIM – QTY. AS PER PLAN & SCHEDULE

Rubbermaid Model 1971258. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. 16 Gallon capacity
- 1 ea. Portable dolly
- 1 ea. Tuffmode Polyliner Bags

Or as manufactured by Brute or Carlisle.

ITEM #44 REFRIGERATOR, PASS-THRU – QTY. AS PER PLAN & SCHEDULE

True Mfg. Model STR1RPT-2HS-2HS-HC. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Verify door hinging
- 1 ea. Self-contained refrigeration
- 4 ea. Stainless steel half doors with locks, pass-thru model
- 3 ea. Stainless steel shelves per compartment, top section
- 1 ea. Digital temperature control system
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- Energy Star® Certified
- Adjustable universal pan slides 1-1/2" O.C. to hold 18" x 26" or 12" x 20" pans, bottom section
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or Beverage Air.

ITEM #45 CABINET, HEATED, PASS-THRU – QTY. AS PER PLAN & SCHEDULE

True Mfg. Model STR1HPT-2HS-2HS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, NEMA 6-15P
- Verify door hinging
- 4 ea. Stainless steel half doors with locks, pass-thru model
- 1 ea. Digital temperature control system
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- Adjustable universal pan slides 1-1/2" O.C. to hold 18" x 26" or 12" x 20" pans, top and bottom section
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or Beverage Air.

ITEM #46 SERVING COUNTER – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Components: Outlets/Junction boxes for drop-in or built-in equipment mounted in counter by K.E.C., wired by E.C.
- Counter Construction: 1" Stainless steel square tubing fully welded with integral chase wall
- Counter Top Material: Stainless Steel, 14 Gauge
- Front Panels: WilsonArt, Premium Collection, as selected by Architect
- End Panels: WilsonArt, Premium Collection, as selected by Architect

- Working Side:
  - Stainless steel interior/exterior
  - Counter/Door to be flush frame design
  - Stainless steel integrated handles, horizontal orientation
  - Cylinder locks, keyed alike, as required
  - Intermediate stainless steel solid shelves, adjustable
  - Stainless steel apron to mount switches, controls, etc.
  - Directional exhaust fan, compressor housing
- Counter Heights: 34" Counter Top
- Counter Base: Stainless steel legs, 6" adjustable with 16 GA removable kick plate, tapered cove

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #47 CASHIER SECTION, BUILT-IN – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #46, Serving Counter
- Electrical: 120/1, NEMA 5-15R
- Working Side:
  - Stainless steel finished interior
  - Stainless steel tubular foot rest, 2" diameter
  - Quad receptacle mounted in rear panel
  - Cord/Plug assembly

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #48 DROP-IN, HOT / COLD UNIT – QTY. AS PER PLAN & SCHEDULE

LTI Model QSCHP-2-H. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-20P
- Verify compressor air flow orientation
- 1 ea. Self-contained refrigeration
- 1 ea. Individually controlled wells for hot or cold
- 1 ea. Controls remote mounted in apron
- 1 ea. Flange style, hugged edge
- 1 ea. Flush food pan presentation
- 1 ea. Manifolded drain lines to gate/shut-off valve
- Adaptor bars to hold combination of 1/1, 1/2, 1/3 and 1/6 sized pans

No alternate manufacturers will be accepted for this item.

ITEM #49 SPARE NUMBER

ITEM #50 DROP-IN, HOT / COLD UNIT – QTY. AS PER PLAN & SCHEDULE

LTI Model DI-QSCHP-3-H. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/208/1, NEMA 14-20P
- Verify compressor air flow orientation

- 1 ea. Self-contained refrigeration
- 1 ea. Individually controlled wells for hot or cold
- 1 ea. Controls remote mounted in apron
- 1 ea. Flange style, hugged edge
- 1 ea. Flush food pan presentation
- 1 ea. Manifoldd drain lines to gate/shut-off valve
- Adaptor bars to hold combination of 1/1, 1/2, 1/3 and 1/6 sized pans

No alternate manufacturers will be accepted for this item.

ITEM #51 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Premier Model TM2N-A. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Gearless adjustment brackets
- LED Strip lights mounted to posts, concealed wiring
- LED Light mounting clips for extended lengths, as required
- 1" Tubular stainless steel posts
- Extend 20" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

No alternate manufacturers will be accepted for this item.

ITEM #52 REFRIGERATED SELF-SERVICE CASE – QTY. AS PER PLAN & SCHEDULE

Structural Concepts Model NR4847RSSV. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-20P
- 1 ea. Free standing style application
- 1 ea. Self-contained refrigeration:
  - Rear access, Breeze™ with Energy Wise
- 1 ea. #4 Finish stainless steel, exterior finish
- 1 ea. #4 Finish stainless steel, interior finish
- 1 ea. WilsonArt, Premium Collection, base finish
- 1 ea. Rear loading access doors, clear glass
- 1 ea. Rear door lock
- 1 ea. Interior LED lighting per shelf
- 1 ea. Sound reduction package
- 1 ea. Roll down security shutter with lock
- 1 ea. Mirrored polished interior ends
- 1 ea. Rear vented panel, stainless steel

Or as manufactured by Federal Industries or RPI.

ITEM #53      SERVING COUNTER – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Components: Outlets/Junction boxes for drop-in or built-in equipment mounted in counter by K.E.C., wired by E.C.
- Counter Construction: 1" Stainless steel square tubing fully welded with integral chase wall
- Counter Top Material: Stainless Steel, 14 Gauge
- Front Panels: WilsonArt, Premium Collection, as selected by Architect
- End Panels: WilsonArt, Premium Collection, as selected by Architect
- Working Side:
  - Stainless steel interior/exterior
  - Counter/Door to be flush frame design
  - Stainless steel integrated handles, horizontal orientation
  - Cylinder locks, keyed alike, as required
  - Intermediate stainless steel solid shelves, adjustable
  - Stainless steel apron to mount switches, controls, etc.
  - Directional exhaust fan, compressor housing
- Counter Heights: 34" Counter Top
- Counter Base: Stainless steel legs, 6" adjustable with 16 GA removable kick plate, tapered cove

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #54      CASHIER SECTION, BUILT-IN – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #53, Serving Counter
- Electrical: 120/1, NEMA 5-15R
- Working Side:
  - Stainless steel finished interior
  - Stainless steel tubular foot rest, 2" diameter
  - Quad receptacle mounted in rear panel
  - Cord/Plug assembly

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #55      DROP-IN, HOT / COLD UNIT – QTY. AS PER PLAN & SCHEDULE

LTI Model QSCHP-2-H. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-20P
- Verify compressor air flow orientation
- 1 ea. Self-contained refrigeration
- 1 ea. Individually controlled wells for hot or cold
- 1 ea. Controls remote mounted in apron
- 1 ea. Flange style, hugged edge
- 1 ea. Flush food pan presentation



- 1 ea. Manifoldd drain lines to gate/shut-off valve
- Adaptor bars to hold combination of 1/1, 1/2, 1/3 and 1/6 sized pans

No alternate manufacturers will be accepted for this item.

ITEM #56 SPARE NUMBER

ITEM #57 DROP-IN, HOT / COLD UNIT – QTY. AS PER PLAN & SCHEDULE

LTI Model DI-QSCHP-3-H. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/208/1, NEMA 14-20P
- Verify compressor air flow orientation
- 1 ea. Self-contained refrigeration
- 1 ea. Individually controlled wells for hot or cold
- 1 ea. Controls remote mounted in apron
- 1 ea. Flange style, hugged edge
- 1 ea. Flush food pan presentation
- 1 ea. Manifoldd drain lines to gate/shut-off valve
- Adaptor bars to hold combination of 1/1, 1/2, 1/3 and 1/6 sized pans

No alternate manufacturers will be accepted for this item.

ITEM #58 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Premier Model TM2N-A. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Gearless adjustment brackets
- LED Strip lights mounted to posts, concealed wiring
- LED Light mounting clips for extended lengths, as required
- 1" Tubular stainless steel posts
- Extend 20" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

No alternate manufacturers will be accepted for this item.

ITEM #59 FIRE EXTINGUISHER, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Ansul Model K-CLASS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. Wet chemical type, Ansulex low pH agent
- 1 ea. 2.5 Gallon tank
- 1 ea. Wall bracket
- 1 ea. Rechargeable
- Wall backing by General Contractor

Or as manufactured by Kidde or RangeGuard.

## PART 3 - EXECUTION

### 3.01 GENERAL RELATED CONDITIONS

- A. In each item of equipment hereinafter specified under the "Equipment Schedule," these specifications shall only identify each respective item by name and number, as well as list various component parts provided for same.
- B. Therefore, it shall be intended that these respective items and their component parts shall be of material (mounted where applicable) constructed and furnished in strict accordance to that described in the general specifications for these items and integrally constructed where applicable.
- C. It shall also be intended that where buy-out (pre-fabricated) items are specified, same shall be definitely furnished with all the accessories as normally furnished by manufacturer for these items. Also in strict accordance with current manufacturer's engineering data sheet for each respective item.

### 3.02 SPECIAL NOTES

- A. It shall be the responsibility of Kitchen Equipment Contractor to keep up to date with progress made in field on installation of all necessary roughing to adequately and properly operate and accommodate all equipment furnished by Kitchen Equipment Contractor and as shown on drawings, to make as many visits to the job site as is necessary to check and assure that all roughing is being properly installed to accommodate this equipment. Include this service in bid.
- B. Kitchen Equipment Contractor to cooperate with all trades so that the end results of his work will be a satisfactory, approved and accepted installation. Written reports of each visit shall be sent promptly to the Architect and the Food Service Consultant.

### 3.03 COORDINATION

- A. Procedure of construction is of paramount importance in executions of this project. Kitchen Equipment Contractor to carry on his work so that no delay in his operations or those of any other contractors occurs at any time.
- B. Kitchen Equipment Contractor to verify with Architect as to opening date of the food service area, and schedule his fabrication and purchasing of equipment so that all will be in readiness, installed, connected, tested, demonstrated, etc., in ample time prior to the scheduled opening date.

### 3.04 DELIVERY AND INSTALLATION

- A. Shall mean and intend that Kitchen Equipment Contractor shall deliver and assemble all equipment of contract in 1 piece in required locations in building, ready for water, waste, gas, electric and ventilating connections required by other contractors. Any pieces of equipment may be delivered sectionally, but all working surfaces butt-welded, ground and polished on premises so that upon completion, such item of equipment will have true, smooth, even and continuous surfaces. Butt joining and filling with solder not permitted. Kitchen Equipment Contractor must verify door sizes, delivery platform, elevator size, etc., effecting delivery to food service areas for all items of equipment.

### 3.05 RESERVATIONS AND CONDITIONS

- A. It is the intent of this specification to complete the installation of all equipment covered herein in all phases ready for operation. Contractor shall carefully examine the plans and specifications for building construction contracts and determine therefrom the extent of his operations in all respects. All labor and materials not included in building construction contracts necessary to accomplish this intent are hereby included in this contract.
- B. Kitchen Equipment Contractor shall attend job meetings when required for purpose of coordinating his work with other trades.
- C. All equipment shall be received at the building fully protected. It will be the responsibility of the Kitchen Equipment Contractor to protect the equipment until completely installed and accepted.

3.06 NOT USED

END OF SECTION



## SECTION 122124 – MANUAL ROLLER SHADE

### PART 1 – GENERAL

#### 1.1 SECTION INCLUDES

- A. Provide manually operated, sunscreen and blackout roller shades as applicable.
- B. Related Sections:
  - 1. Division 09 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for blocking, installation of shade pockets, closures and related accessories.
  - 2. Division 09 - Acoustical Ceilings: Coordination with acoustical ceiling systems for blocking, installation of shade pockets, closures and related accessories.
  - 3. Division 26 - Electrical: Electric service for EDU's, and EDU controls, internal communication, low voltage wiring and data transfer, and connection to the Internet and required.

#### 1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
  - 3. Storage and handling requirements and recommendations.
  - 4. Mounting details and installation methods.
  - 5. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.
- B. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- C. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- D. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- E. Warranty: Provide manufacturer's warranty documents as specified in this Section.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section. This includes but is not limited to all required extrusions, accessories, controls and fabricated roller shades or else all stated and published warranties may be void.
- B. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- C. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### 1.6 WARRANTY

- A. Warranty: Provide manufacturer's standard warranties, including the following:
  - 1. Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
  - 2. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to access to the work above 12' Feet AFF, which are the responsibility of others.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURER

- A. Basis of Design Manufacturer for Window Shade System: Products by MechoSystems; 42-03 35<sup>th</sup> Street, Long Island City, NY 11101. Tel: (718) 729-2020 ext 1901; Mr. Glen Berman. Email: [glenb@MechoSystems.com](mailto:glenb@MechoSystems.com).

#### 2.2 SHADE BANDS

- A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
  - 1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
    - a. Hembar shall be heat sealed on all sides.

- b. Open ends shall not be accepted.
2. Shade Band and Shade Roller Attachment:
- a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
  - b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a “snap-on” snap-off” spline mounting, without having to remove shade roller from shade brackets.
  - c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
  - d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

### 2.3 ROLLER SHADE FABRICATION

- A. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design.
  - B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
  - C. For railroaded shade bands, provide seams in railroaded multi-width shade bands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shade bands
  - D. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shade bands.
  - E. Blackout shade bands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally colored fabric to match the inside and outside colors of the shade band, in accordance with manufacturer's published standards for spacing and requirements.
- 1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

### 2.4 ROLLER SHADE COMPONENTS

- A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
  - a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
  - b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
  - c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
  - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in



raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

- e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
9. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

## 2.5 SHADECLOTH

- A. Visually Transparent Single-Fabric Shadecloth: MechoSystems, ThermoVeil® group, single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

- 1. Dense Linear Weave: "1000 series", 3 percent open, dense linear-weave pattern.
- 2. Color: Selected from manufacturer's standard colors.

## 2.6 ROLLER SHADE ACCESSORIES

- A. Shade Pocket: For recessed mounting in acoustical tile or drywall ceilings as indicated on the drawings.

- 1. Either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

- B. Fascia:

- 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
- 2. Fascia shall be able to be installed across two or more shade bands in one piece.
- 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
- 4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

- C. RESCUE WINDOWS

- 1. When a rescue window is required, window blinds must also be provided with a marking that meets the following requirements:
  - a. Color: bright yellow background with black letters
  - b. Size: 3 inches by 5 inches
  - c. Text: Rescue Window

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION OF ROLLER SHADES

- A. Contractor Furnish and Install Responsibilities:
  - 1. Window Covering Contractor (WC) shall provide an on site, Project Manager, and shall be present for all related jobsite scheduling meetings.
  - 2. WC shall supervise the roller shade installation, and setting of intermediate stops of all shades to assure the alignment of the shade bands within a single EDU group, which shall not exceed +/- 0.125 inches (3.175mm), and to assure the alignment between EDU groups, which shall not exceed +/- 0.25 inches (6.35mm).
  - 3. WC shall be responsible for field inspection on an area-by- area and floor-by-floor basis during construction to confirm proper mounting conditions per approved shop drawings.
  - 4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor and Owner of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
  - 5. WC shall provide accurate to 0.0625 inch (1.5875mm); field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
  - 6. WC Installer shall install roller shades level, plumb, square, and true according to manufacturer's written instructions, and as specified here in. Blocking for roller shades installed under the contract of the interior General Contractor shall be installed plumb, level, and fitted to window mullion as per interior architect's design documents and in accordance with industry standard tolerances. The horizontal surface of the shade pocket shall not be out-of-level more than 0.625 inch (15.875mm) over 20 linear feet (6.096 meters)
  - 7. Shades shall be located so the shade band is not closer than 2 inches (50 mm) to the interior face of the glass. Allow proper clearances for window operation hardware.
  - 8. Adjust, align and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
  - 9. Installer shall set Upper, Lower and up to 3 intermediate stop positions of all motorized shade bands and assure alignment in accordance with the above requirements.
  - 10. WC shall certify the operation of all motorized shades and turn over each floor for preliminary acceptance.

11. The WC shall participate and cooperate with the electrical contractor, the window shade manufacturer and the Commissioning agent to verify and certify the installation is in full conformance with the specifications and is fully operational. This work to occur during the commissioning stage and is in addition to preliminary acceptance required for each floor.
12. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
13. WC shall train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.
14. Protect installed products until completion of project.
15. Touch-up, repair or replace damaged products before Substantial Completion.

#### 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 122124



## SECTION 123554 – MANUFACTURED CASEWORK

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Plastic Laminate Casework
- B. Countertop Grills & Toespace grills
- C. Countertops (see separate specification for solid surface)

#### 1.2 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry: Framing and blocking in walls, floors and ceiling to support equipment.
- B. Section 220511 - Common Work Results for Plumbing: Connections for drain lines, service piping, vents, re-vents, in-line vacuum breakers, special plumbing fixtures, traps and tailpieces to service fixtures.

#### 1.3 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Indicate locations of blocking and reinforcements required for installing casework.
  - 2. Indicate locations and types of service fittings, together with associated service supply connection required.
  - 3. Include details of utility spaces.
  - 4. Include indicators of exposed conduits, if required, for service fittings.
  - 5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
  - 6. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Certificate of Origin: Manufacturer must supply with first submittal, an example of their Certificate of Origin declaring casework is wholly manufactured and assembled specifically in the United States, including city, county, and state locations. A notarized Certificate of Origin must be provided with closeout documents.
- D. Selection Samples: For each finish product specified, one complete set of color chips representing manufacturer's full range of available colors and patterns.
  - 1. One set of samples indicating full range of finishes for countertop specified.
  - 2. One set of casework samples indicating full range of finishes for casework specified.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Not less than 5 years experience in the actual production of specified products. Casework shall be wholly manufactured and assembled in the USA: i.e. "American Made".
- B. Installer Qualifications: Firm with 5 years experience in installation or application of systems similar in complexity to those required for this Project, plus the following.
  - 1. Authorized distributor of manufacturer.

- C. Mock-Up: Provide a mock-up for evaluation of fabrication techniques and application workmanship. To be provided 7 days in advance of bid for manufactures seeking consideration.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until project conditions are ready for installation.

#### 1.6 PROJECT CONDITIONS

- A. For delivery and installation of laboratory casework and equipment, building conditions shall comply with AWI Standard 1700-G-3 and 1700-G-4 and be as follows:
  - 1. Flooring required to be placed under casework and equipment installed.
  - 2. Wood or metal blocking (wall grounds) installed within partitions to allow for immediate installation upon delivery.
  - 3. Heating and air conditioning systems providing consistent temperature and humidity conditions to comply with by AWI Standard 1700-G-4 and 1700-G-5.
  - 4. Relative humidity not less than 40 percent, nor more than 60 percent.
  - 5. Temperatures not less than 65 degrees F (18 degrees C) and not greater than 80 degrees F (27 degrees C) in areas of casework and equipment installation.
  - 6. Overhead mechanical, electrical and plumbing rough-in work is complete.
  - 7. Wet operations complete prior to delivery.
  - 8. Ceiling grids (with or without ceiling tiles), overhead soffits, ductwork and lighting installed.
  - 9. Painting complete.

#### 1.7 WARRANTY

- A. Casework Manufacturer Warranty: 3 years from date of delivery. Warranty is for the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly investigate, and address said deficiencies.
  - 1. Defects in materials and workmanship.
  - 2. Deterioration of material and surface performance below minimum SEFA 8 standards as certified by independent third-party testing laboratory.
  - 3. Within the warranty period, we shall, at our option, repair, replace, or refund the purchase price of defective casework.
- B. Casework manufacturer shall be notified immediately of defective products and be given a reasonable opportunity to inspect the goods prior to return. Casework manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Casework manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of casework; and, shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of their products.
  - 1. The warranty with respect to products from another company sold by the casework manufacturer is limited to the warranty extended by that other company.
- C. Casework manufacturer shall provide, with close-out documents, a Certificate of Warranty for products provided.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Case Systems, 2700 James Savage Road, Midland, Michigan 48642 (989) 496-9510 and/or approved dealers.
- B. Preapproved Acceptable Manufacturers: TMI Systems
- C. Substitution Limitations:
  - 1. Substitutions will be considered only when other manufacturers submit substitution requests in accordance with procurement substitution and/or substitution procedures, or provide a comparable product with the following support information detailed below:
    - a. Written documentation stating specification compliance regarding construction, materials, and standard of quality and manufacturing techniques.
    - b. Note all deviations to the drawings and/or specifications in writing.
    - c. The owner, or its designated representative, reserves the right to reject any proposal that in his opinion fails to meet the criteria established by this specification. Such a decision shall be final.

### 2.2 CONSTRUCTION

- A. Plastic laminate on particleboard core: Casework.
- B. Cabinet Finish, Interiors and Exteriors Match Finished:
  - 1. Plastic laminate. Refer to Finish Schedule and drawings for plastic laminate types and locations. (Thermofuse cabinet interiors & exteriors are NOT to be provided)
- C. Drawer and Door Styles:
  - 1. Drawer and Door Styling: Doors and drawers are 3/4 inch thick and have a particleboard core with plastic laminate face and back with 1/8 inch PVC edge-band.
- D. Door and Drawer Hardware Style:
  - 1. Drawer Slides:
    - a. Drawer Epoxy powder coated, cold rolled steel, heavy-duty with a 100 lbs (45 kilograms) load capacity. They are equipped with heavy-duty, nylon rollers for smooth effortless operation. Slides have automatic positive stop to prevent drawer's accidental removal but allow for quick removal without tools.

### 2.3 MATERIALS

- A. Hardboard used in drawer bottoms and unexposed backs, consists of super-refined wood fibers and chips, highly compressed into a hard, dense, 1/4 inch thick, homogeneous sheet, faced with wood grain pattern melamine on the exposed face. Physical properties: Average MOR is 5,000 lbs/sq inches (3.5 kgf/sq mm); density is 48 lbs/cu ft (0.6 kg/cu m); and MOE of 500,000 psi (350 kgf/sq mm). All hardboard shall be CARB Phase 1 compliant.
- B. Particleboard is industrial grade, with the following physical properties: Density, 48 lb/cu. ft. (0.6 kg/cu m); minimum modulus of rupture 2,200 psi (1.5 kgf/sq mm); minimum modulus of elasticity 450,000 psi (315 kgf/sq mm). All particleboard shall be CARB Phase 1 compliant.

- C. High-pressure plastic laminate, regular grade, is melamine impregnated decorative surface papers, superimposed over kraft phenolic core sheets, vertical grade, high pressure, plastic laminate has a nominal thickness of 0.030 inch complying with NEMA LD 3.
  - 1. Exposed interior and exposed exterior surfaces.
- D. Low-pressure plastic laminate are panels of melamine resin impregnated decorative paper, thermally fused to industrial grade particleboard or to service tempered hardboard. Thermal fusion under heat and pressure, permanently bonds the resin-impregnated paper to the substrate and produces a permanent bond between the melamine surface and the substrate. Low-pressure plastic laminate is frosty white in color. Low-pressure plastic laminated to hardboard is used as drawer bottoms and unexposed interior backs.
  - 1. Unexposed and concealed interior and unexposed exterior.

## 2.4 FABRICATION

- A. Cabinets have a 1 inch by 4 inches, low-pressure plastic laminate on particleboard core horizontal front and back top frame member, with black PVC edge-band on front member. Front intermediate rail is 10-5/8 inches by 3/4 inch, low- pressure plastic laminate on particleboard core. Exposed exterior backs are high-pressure plastic laminated 3/4 inch particleboard. Cabinets with exposed interiors but unexposed exteriors have 3/4 inch particleboard, and the unexposed surface is laminated with low-pressure plastic laminate. Cabinets with unexposed interiors and exteriors have faces of low-pressure plastic laminated 1/4 inch hardboard. Exposed interior or exterior end panels are high-pressure plastic laminated 3/4 inch particleboard. Unexposed interior or exterior end panels are low-pressure plastic laminated 3/4 inch particleboard. Bottom, shelves, and dividers in cabinets with exposed interiors are high-pressure plastic laminated 3/4 inch particleboard; with unexposed interiors is low-pressure plastic laminated 3/4 inch particleboard. Exposed edges of end panels, bottom, shelves and dividers are edged with black PVC, applied after lamination. Color coordinated PVC must be specified, Drawer separators, furnished only when specified, are full depth, 3/4 inch, and low-pressure plastic laminate on particleboard core.
- B. Cabinet construction is bored, doweled, dadoed, glued and screwed construction. Cabinets are enclosed without the use of common partitions. A full horizontal, mortise, tenon and glued, top frame is bored, doweled, glued, and reinforced with six (6) screws into the cabinet. Intermediate front rails and bottom rear horizontal parting rails are provided as required. Separators, where specified, are let into routed intermediate rails. Backs are recessed and encapsulated into dadoed end panels then screwed into the top and bottom case members. A standard enclosed toe space, 2-1/4 inches by 4 inches high, is provided, with toe rail bored, doweled and glued to end panels; however, casework cabinets, when in a library assembly such as a circulation desk, will have an enclosed toe space 2-1/4 inches deep by 6 inches high. Shelves are supported on heavy-duty, laboratory grade, twin pin plastic shelf clips, which fit into two double rows of holes drilled 1-1/4 inches on centers, in the case end panels for maximum shelf adjustability.
- C. Construction - Wall and Upper Cases: Wall and upper cases have components that are laminate on particleboard core. Adjustable shelves are 1 inch thick particleboard with laminate faces and appropriate edging. Backs, in cases with exposed interiors and exposed exteriors are 1/4 inch thick hardboard with melamine face. Backs in cases with unexposed interiors and unexposed exteriors are 1/4 inch hardboard with melamine face. Exterior back cross rails: 4 inches by 3/4 inch hardwood plywood.



- D. Construction - Tall Cases: Top panels in tall cases with exposed interiors are 1 inch hardwood plywood; tall cases with unexposed interiors have top panels of 1 inch plywood. Bottom panels in tall cases with exposed interiors are 3/4 inch hardwood plywood; and unexposed interiors have 3/4 inch plywood. Interiors, whether exposed or unexposed, are stain color matched to the exterior finish. Adjustable shelves are 1 inch thick hardwood plywood if exposed; 1 inch plywood if unexposed. Shelves are edged with 1/8 inch solid hardwood edging. Backs in tall cases with exposed interiors and exposed exteriors, are 1/4 inch hardwood plywood. Tall cases with unexposed interior or exterior backs have 1/4 inch hardboard melamine color stain matched to the interior. End panels in tall cases with exposed end panels have 3/4 inch hardwood plywood. End panels in cases with unexposed end panels have 3/4 inch plywood. All exposed edges of hardwood plywood components and plywood components are edged with 1/8 inch solid hardwood edging. Tall cases have two exterior hardwood plywood cross rails, 4 inches by 3/4 inch. Tall cases are rigidly constructed, integral units with the strongest, most advanced joinery methods utilized of bored, doweled, dadoed, glued and screwed construction. Each case is completely enclosed without the use of common partitions and has flush construction with overlapping doors to provide a dust resistant interior. The top panel is bored, doweled and glued into end panels; and the bottom panel is bored, doweled and glued into end panels and glued and screwed to the back. Additional back cross rails are provided as required. Backs are recessed and encapsulated into dadoed end panels and screwed to the top and bottom tall case members. An enclosed toe space 2-1/4 inch by 4 inches is provided with toe rail securely bored, doweled and glued to end panels and bottom panel. Adjustable shelves are supported on heavy-duty laboratory grade, twin pin plastic shelf clips, which fit into two rows of holes drilled 1-1/4 inches on centers in the end panels, for maximum shelf adjustability.

## 2.5 CABINET HARDWARE

- A. Provide I casework manufacturer's standard finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges to be selected from manufacturers standard
- C. Pulls are wire design: stainless steel
- D. Locks on all cabinet doors and drawer to be 5 disc type with master keys
- E. Friction roller or magnetic catch catch is zinc plated steel catch with a spring cushioned; polyethylene roller, and a metal strike plate. Screw mounted catches and strike plate have slotted holes for adjustability.
- F. Shelf clips are made from clear polycarbonate. Clips have double, 3/16 inch diameter pins and are equipped with shelf lock hold down tabs for 3/4 inch or 1 inch thick shelves.

## 2.6 COUNTER TOPS- Solid Surface countertops and splash - see specification section

- 2.7 COUNTERTOP GRILLS AND TOE SPACE GRILLS - Aluminum- clear satin finish, pencil proof for countertop drop in grills. Stamped Steel painted flat black for toe space grills. Sizes as indicated on drawings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install casework in accordance with manufacturer's instructions.
1. Installation of casework shall be plumb, level, true and straight, with no distortions.
  2. Use concealed shims as required.

3. Where laboratory casework or equipment butts against other finished work, scribe and cut for an accurate fit.
  4. Lubricate operating hardware as recommended by the manufacturer.
- B. Install countertop and edge surfaces in one plane with flush hairline seams. Locate seams where shown on Shop Drawings.
1. Provide required holes and cutouts for sinks as shown on Shop Drawings.
  2. Seal unfinished edges and cutouts in plastic-laminate countertops.
  3. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Coordination with Mechanical, Plumbing and Electrical Contractors.
- D. Touch-up, repair replace damaged products before Substantial Completion.

END OF SECTION 123554

## SECTION 124840 – ENTRANCE MATS AND GRATES

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. This section includes the following types of Flooring Systems:

1. Entrance Matting and Framing Assemblies

#### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. National Fire Protection Agency (NFPA)
- C. The Aluminum Association, Inc.
- D. The Carpet and Rug Institute (CRI)
- E. The National Floor Safety Institute (NFSI)
- F. ADA Accessibility Guidelines (CFR Part 36 Appendix A)
- G. Surface Flammability of Carpets and Rugs (CFR 16 Part 1630 and 1631)

#### 1.03 SUBMITTALS

- A. Submit the following in accordance with specification section 01300 and contract requirements.
- B. Product data for each type of entrance matting and frame to include:
  - 1. Product detail drawing including product cross-section and technical information.
  - 2. Manufacturer's product specification, installation instructions.
  - 3. Manufacturer's maintenance and cleaning instructions.
  - 4. Shop drawings showing traffic direction, dimensions, sectioning, insert types and colors, metal finishes and framing.
- C. Product samples representing the assembled matting with the selected insert and insert color selector, and frame assembly including installation accessories.

#### 1.04 QUALITY ASSURANCE

- A. Flammability: Critical radiant flux 0.45 watts/m<sup>2</sup> or greater, in accordance with ASTM E648. Life Safety Code<sup>®</sup> NFPA 101, Class 1 Interior Floor Finish Testing and Classification.
- B. Slip Resistance: Coefficient of friction 0.60 or greater, in accordance with ASTM D2047 tested in wet conditions.

- C. Rolling Load: No deformation with 350 lb/wheel and minimum of 2500 passes. Load applied to a 5" diameter, 2" wide solid polyurethane wheel.
- D. Single Source: Obtain entrance matting and frames from a single source to ensure dimensional compatibility.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in unopened original factory packaging, labeled to identify product and manufacturer. Store in controlled environment. To avoid damage do not stack other material on top of matting or frames.

#### 1.06 PROJECT CONDITIONS

- A. Coordinate installation of recess frame with concrete construction. Install frames to ensure dimensions provided in shop drawings are maintained. Finished recess must be flat and level. Defer frame installation until related interior finish work is in progress.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Supply entrance matting and frames as manufactured by the Architectural Products Division of Pawling Corporation, 32 Nelson Hill Road, Wassaic, NY 12592.
- B. Other manufacturers must comply with requirements indicated in this specification, products data, and shop drawings.

#### 2.02 MATERIALS

- A. Aluminum: ASTM B221, alloy 6105-T5 and 6063-T5 for extrusions.
- B. Architectural Bronze: ASTM B455, alloy 385 for extrusions.
- C. Rigid Vinyl: High impact, rigid PVC.
- D. Flexible Vinyl: 80 Durometer, flexible PVC.
- E. Tread Inserts: Refer to section 2.03

#### 2.03 ENTRANCE MATTING

- A. Pawling Corporation model RG-250 Drain-Well® Entrance Grating. Manufactured from high strength aluminum alloy tread-rail extrusions spaced at 1.5" centers, connected by continuous rigid vinyl hinges perforated to provide drainage. Tread rails to include continuous flexible vinyl cushion for contact with substrate and tread rail insert (selected from options listed below) for exposed walking surface. Flexible vinyl spacers provided on leading and trailing edges as required when recess opening cannot be accommodated by a whole number of rails. Tread rails are standard in mill finish aluminum. Also available in clear, medium bronze, and black anodized finishes.

B. Tread Inserts (select from options listed below)

1. Rigid-Back Nylon "SNC" Carpet: Solution dyed, 100% nylon, 33.8oz/sqyd available in manufacturer's standard colors. Carpet fibers fusion bonded to continuous two-ply rigid backing. Carpet fibers incorporate anti-stain (Teflon), anti-static, and anti-microbial additives.
2. Bristle Filament "BF" Carpet: Solution dyed polypropylene fibers, 27oz/sqyd with a 50% blend of 600/12- denier multi filament and 595/D1 monofilament, available in manufacturer's standard colors. Passes 16 CFR Part 1630 (FF 1-70) and 16 CFR Part 1631 (FF 2-70) flammability. Bristle Filament is not Class 1. Carpet fibers to be fusion bonded to continuous two-ply rigid backing. Fibers are waterproof and incorporate UV inhibitors for exterior use.
3. Maxi-Tuft Long Wear "MLW" Carpet: Spaced dyed, 100% polyamide nylon, tetra-lobal fibers, 30oz/sqyd available in manufacturer's standard colors. Carpet fibers fusion bonded to continuous two-ply rigid backing. Carpet fibers incorporate anti-stain, anti-static, and anti-microbial additives.
4. Rigid Corrugated Vinyl "RCV": Rigid vinyl extrusion with corrugated surface for improved slip resistance, available in manufacturer's standard colors. Manufactured with UV stable pigments for improved color fastness.
5. Corrugated Aluminum "CA": Alloy 6105-T5 extruded aluminum with corrugated surface for improved slip resistance, available in mill finish.
6. Abrasive Aluminum "AA": Alloy 6105-T5 extruded aluminum with applied medium grit abrasive for maximum slip resistance. Aluminum is mill finish with abrasive available in manufacturer's standard colors.

C. Flexible Vinyl Nosing

1. Square Nosing: Flexible vinyl nosing model EMV-250 for recess openings not accommodated by a whole number of aluminum tread rails. Nosing can be field trimmed to accommodate slight irregularities in the recess opening.

D. Framing

1. Level Bed: Model RGF-250, alloy 6063-T5 extruded aluminum recessed framing. Installed frame provides 1/2" exposed perimeter trim and a 3/4" deep recess. Standard in mill finish aluminum, also available in clear, medium bronze, and black anodized finishes (specify anodized finish for best resistance to contact with concrete). Installer to use self-leveling screed to ensure smooth, flat recess.
2. Angle Frame: Model SSF-250, alloy 6105-T5 extruded aluminum angle frame. Installed frame provides 1/8" exposed perimeter trim and a 3/4" deep recess. Standard in mill finish aluminum, also available in clear, medium bronze, and black anodized finishes (specify clear anodized finish for best resistance to contact with concrete). Installer to use self-leveling screed to ensure smooth, flat recess.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate and area where matting is to be installed. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's installation instructions.
- B. Recessed opening must be flat, 1/8" in 10'-0", and free of debris before Matting is installed.

### 3.03 PROTECTION

- A. Protect installed frames from damage by using temporary plywood filler in recess opening. Cover exposed frames with similar materials until construction traffic is minimized. Install matting when project is near substantial completion and no further wheeled traffic or major construction operations will affect matting.

### 3.04 CLEANING

- A. Include matting and recess in a routine cleaning and maintenance program. Regular cleaning will maximize functionality, appearance, and life span of the product. Refer to manufacturer's cleaning and maintenance instructions for additional information.

END OF SECTION 124840

## SECTION 142100 – ELECTRIC TRACTION ELEVATORS

### PART 1 - GENERAL

#### 1.01 Summary

- A. This section specifies electric traction elevators.
- B. Work Required
  - 1- The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
  - 2- All work shall be performed in a first class, safe and workmanlike manner.
  - 3- In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

#### 1.02 Related Sections

- A. The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.
  - 1- Section 01 50 00 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
  - 2- Section 03 30 00 – Cast-In-Place Concrete: elevator pit and elevator machine foundation.
  - 3- Section 04 20 00 – Concrete Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
  - 4- Section 26 05 00 – Common Work Results for Electrical:
  - 5- Main disconnects for each elevator.
  - 6- Electrical power for elevator installation and testing.
  - 7- Disconnecting device to elevator equipment prior to activation of sprinkler system.
  - 8- The installation of dedicated GFCI receptacles in the pit and overhead.
  - 9- Lighting in controller area, machine area and pit.
  - 10- Wiring for telephone service to controller.
  - 11- Section 28 31 01 – Fire Alarm Systems: fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine area.
  - 12- Section 31 10 00 – Site Clearing: excavation for elevator pit.

#### 1.03 References

- 1- Comply with applicable building and elevator codes at the project site, including but not limited to the following:
- 2- ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
- 3- ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
- 4- ADAAG, American Disabilities Act Accessibility Guidelines.
- 5- ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.

- 6- ANSI/NFPA 70, (NEC) National Electrical Code.
- 7- CAN/CSA C22.1, (CEC) Canadian Electrical Code.
- 8- ANSI/UL 10B, Standard for Fire Test of Door Assemblies.
- 9- CAN/ULC-S104-10, Standard Method for Fire Test of Door Assemblies.
- 10- ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives.
- 11- Building Codes IBC or NBCC.
- 12- All Local Jurisdictional applicable codes.

1.04 System Description for 3500 lbs- Unit 1

- A. Equipment Description: Gen2® gearless elevator where the controller resides in a machine room.
- B. Equipment Control: Elevonic® Control System.
- C. Drive: Regenerative
- D. Quantity of Elevators: 1 of 1
- E. Elevator Stop Designations:
  - Front- 1<sup>st</sup> Floor, 2<sup>nd</sup> Floor,
  - Rear- Upper Lobby, 3<sup>rd</sup> Floor, 4<sup>th</sup> Floor
- F. Stops: 5
- G. Openings: Front and Rear
- H. Travel: 40 ft 6.5 in
- I. Rated Capacity: 3500 lbs.
- J. Rated Speed: 200 fpm (1.02 mps)
- K. Clear Hoistway Size: 7'-5 1/4" W x 9'-1" D
- L. Clear Inside Dimensions: 5'-6 1/8" W x 6'-5 9/16" D
- M. Cab Height: High Cab
- N. Entrance Type and Width: Two-Speed Doors- 42"
- O. Entrance Height: 7'-0" (2134 mm)
- P. Main Power Supply: 208 or 480 volts as indicated on the plans ☐ 5% of normal, three-phase, with a separate equipment grounding conductor.
- Q. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.
- R. Machine Location: Inside and at the top of the hoistway.
- S. Signal Fixtures: Manufacturer's standard with metal button targets
- T. Controller Location: In a machine room.
- U. Performance:
  - 1- Car Speed: ☐ 3 % of contract speed under any loading condition or direction of travel.
  - 2- Car Capacity: Safely lower, stop and hold up to 120% of rated load (code required).



3- Ride Quality:

- a. Vertical Vibration (maximum): 20 milli-g
- b. Horizontal Vibration (maximum): 12 milli-g
- c. Vertical Jerk (maximum): 4.59  $\square$  1.0 ft./ sec<sup>3</sup> (1.4  $\square$  0.3 m/ sec<sup>3</sup>)
- d. Acceleration/Deceleration (maximum): 2.62 ft./ sec<sup>2</sup> (0.8 m/ sec<sup>2</sup>)
- e. In Car Noise: 55 – 60 dB(A)
- f. Stopping Accuracy:  $\square$ 0.375 in. ( $\square$ 10 mm) max,  $\square$ 0.25 in. ( $\square$ 6 mm) Typical
- g. Re-leveling Distance:  $\square$ 0.5 in. ( $\square$ 12 mm)

V. Operation: Simplex Collective: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

W. Operation Features

- 1- Full Collective Operation
- 2- Anti-nuisance
- 3- Fan and Light Protection
- 4- Load Weighing Bypass
- 5- Independent Service
- 6- Firefighters' Service Phase I and Phase II
- 7- Top of Car Inspection
- 8- Zoned Access at Bottom Landing
- 9- Zoned Access at Upper Landing
- 10- Car Secure Access
- 11- Automatic Rescue Operation.

X. Door Control Features:

- 1- Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
- 2- Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
- 3- Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.
- 4- Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

Y. Provide equipment for seismic conditions.

1.05 Submittals

A. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:

- 1- Signal and operating fixtures, operating panels and indicators.
  - 2- Cab design, dimensions and layout.
  - 3- Hoistway-door and frame details.
  - 4- Electrical characteristics and connection requirements.
  - 5- Expected heat dissipation of elevator equipment in hoistway (BTU).
  - 6- Color selection chart for Cab and Entrances.
- B. Shop Drawings: Submit approval layout drawings. Include the following:
- 1- Car, guide rails, buffers, and other components in hoistway.
  - 2- Maximum rail bracket spacing.
  - 3- Maximum loads imposed on guide rails requiring load transfer to building structure.
  - 4- Clearances and travel of car.
  - 5- Clear inside hoistway and pit dimensions.
  - 6- Location and sizes of access doors, hoistway entrances and frames.
- C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.
- 1.06 Quality Assurance
- A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.
- B. Manufacturer shall have a minimum of fifteen years of experience in the fabrication, installation and service of elevators.
- C. Installer: Elevators shall be installed by the manufacturer.
- D. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.
- 1.07 Delivery, Storage, and Handling
- A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.
- B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage and redelivery to the job site shall not be at the expense of the elevator contractor.
- 1.08 Submittals
- A. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:
- 1- Signal and operating fixtures, operating panels and indicators.
  - 2- Cab design, dimensions and layout.

- 3- Hoistway-door and frame details.
  - 4- Electrical characteristics and connection requirements.
  - 5- Expected heat dissipation of elevator equipment in hoistway (BTU).
  - 6- Color selection chart for Cab and Entrances.
  - B. Shop Drawings: Submit approval layout drawings. Include the following:
    - 1- Car, guide rails, buffers, and other components in hoistway.
    - 2- Maximum rail bracket spacing.
    - 3- Maximum loads imposed on guide rails requiring load transfer to building structure.
    - 4- Clearances and travel of car.
    - 5- Clear inside hoistway and pit dimensions.
    - 6- Location and sizes of access doors, hoistway entrances and frames.
  - C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.
- 1.09 Quality Assurance
- A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.
  - B. Manufacturer shall have a minimum of fifteen years of experience in the fabrication, installation and service of elevators.
  - C. Installer: Elevators shall be installed by the manufacturer.
  - D. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.
- 1.10 Delivery, Storage, and Handling
- A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.
  - B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage and redelivery to the job site shall not be at the expense of the elevator contractor.
- 1.11 Warranty
- A. The elevator contractor's acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

## 1.12 Maintenance and Service

- A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of 12 months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.
- B. The periodic lubrication of elevator components shall not be required, including: Sheaves, Rails, Belts, Ropes, Car and CWT guides, etc.
- C. The elevator control system must:
  - 1- Provide in the controller the necessary devices to run the elevator on inspection operation.
  - 2- Provide on top of the car the necessary devices to run the elevator in inspection operation.
  - 3- Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.
  - 4- Provide in the event of a power outage, means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
  - 5- Provide the means from the controller to reset the governor over speed switch and also trip the governor.
  - 6- Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
  - 7- (Optional) Provide the means from the controller to reset elevator earthquake operation.
- D. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
  - 1- Remotely diagnose elevator issues with a remote team of experts
  - 2- Remotely return an elevator to service
  - 3- Provide real-time status updates via email
  - 4- Remotely make changes to selected elevator functions including:
    - a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode and activate independent service.
    - b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
    - c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

## PART 2 - PRODUCTS

### 2.01 Manufacturer

- A. Manufacturer: Design based upon Otis Elevator's Gen2™ machine room-less elevator system.

## 2.02 Design and Specifications

- A. Provide Gen2™ traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
  - 1- Controller located in a machine room.
  - 2- An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.
  - 3- Polyurethane Coated-Steel Belts for elevator hoisting purposes.
  - 4- Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
  - 5- LED lighting standard in ceiling lights and elevator fixtures.
  - 6- Sleep mode operation for LED ceiling lights and car fan.
- B. Approved Installer: Otis Elevator Company

## 2.03 Equipment: Controller Components

- A. Controller: A microcomputer based control system shall be provided to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.
  - 1- All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
  - 2- Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
  - 3- Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
  - 4- Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"
  - 5- Controller located inside a control room.
  - 6- Drive: A Variable Voltage Variable Frequency AC drive system shall be provided. The drive shall be set up for regeneration of AC power back to the building grid.

## 2.04 Equipment: Hoistway Components

- A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.
- B. Governor: The governor shall be a tension type car-mounted governor.
- C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute. Oil buffers shall be used for a speed of 350 feet per minute.
- D. Hoistway Operating Devices:
  - 1- Emergency stop switch in the pit.
  - 2- Terminal stopping switches.
- E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

- F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.
- G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.
- H. Governor Rope: The Governor rope shall be steel and shall consist of at least eight strands wound about a sisal core center.
- I. Fascia: Galvanized sheet steel shall be provided at the front of the hoistway.
- J. Hoistway Entrances:
  - 1- Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
  - 2- Sills Shall Be: Extruded Aluminum Sills
  - 3- Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
  - 4- Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour
  - 5- Frame and Entrance Finishes:
    - Brushed Stainless Steel Frames and Entrances
  - 6- Entrance Marking Plates: Entrance jambs shall be marked with 4" x 4" (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
  - 7- Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.

#### 2.05 Equipment: Car Components

- A. Car Frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp type.
- B. Cab: Premium, Steel Shell Cab
- C. Wall Panels: Raised rigidized-stainless steel
- D. Brushed Stainless Steel finished base plate located at top and bottom.
- E. Brushed Stainless Steel finished vertical trim pieces
- F. Car Front Finish: Satin Stainless Steel
- G. Car Door Finish: Satin Stainless Steel
- H. Ceiling Type: Flat Ceiling with 4 LED Lights

- I. Ceiling Finish: Brushed Steel Finish
  - J. Fan: A two-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan. A variable speed fan will be available when Glassback cab option is selected.
  - K. Handrail: 3/8" x 2" (9.5 mm x 51 mm) Flat Tubular Bars with Brushed Steel Finished handrails shall be provided on the side walls.
  - L. Threshold: Extruded Aluminum
  - M. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
  - N. Guides: The car shall have 3" diameter roller guides at top and bottom and the counterweight shall have slide type guides at the top and the bottom. Optional counterweight guides available.
  - O. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.
  - P. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.
  - Q. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.
- 2.06 Equipment: Signal Devices and Fixtures
- A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.
    - 1- A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings. The buttons shall be: Lexan 1/8" (3mm) projecting buttons, fully illuminated by a white LED.
    - 2- The car operating panel shall be equipped with the following features:
      - a. Raised markings and Braille to the left hand side of each push-button.
      - b. Car Position Indicator at the top of and integral to the car operating panel.
      - c. Door open and door close buttons.
      - d. Inspection key-switch.
      - e. Elevator Data Plate marked with elevator capacity and car number.
      - f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

- g. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator. Car Position Indicator is at the top of and integral to the car operating panel.
  - h. In car stop switch (toggle or key unless local code prohibits use)
  - i. Firefighter's hat
  - j. Firefighter's Phase II Key-switch
  - k. Call Cancel Button
  - l. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2. - Optional
  - m. Please Exit Symbol: provided with emergency hospital service, Seismic Zones  $\geq 2$  or express priority in the hall. - Optional
- B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.
- C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. All Hall fixtures shall have a Brushed Stainless Steel Finish.
- 1- Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face or the wall. Buttons shall be in vertically mounted fixture. Fixture shall be satin stainless steel finish.
  - 2- Hall Buttons:  
Flat Flush Mounted satin stainless steel button with blue or white LED illuminating halo
- D. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- E. Hall Position Indicators at: G
- F. Access key-switch at top floor in entrance jamb.
- G. Access key-switch at lowest floor in entrance jamb.

### PART 3 - EXECUTION

#### 3.01 Preparation

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

#### 3.02 Installation

- A. Installation of all elevator components except as specifically provided for elsewhere by others.



3.03 Demonstration

- A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

END OF SECTION 142100



## SECTION 210529 – PIPE HANGERS AND SUPPORTS

### PART 1 - GENERAL

#### 1.01 SUBMITTALS

##### A. Shop Drawings:

1. Details of trapeze hangers and upper hanger attachments for piping 4 inches in diameter and over. Include the number and size of pipe lines to be supported on each type of trapeze hanger.

#### 1.02 QUALITY ASSURANCE

##### A. Regulatory Requirements:

1. Comply with the applicable requirements of the ASME B31 Piping Codes.
2. Unless otherwise shown or specified, comply with the requirements of the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.
3. Materials for use in Sprinkler Systems and Standpipe and Hose Systems shall comply with the requirements of NFPA 13 and NFPA 14 as applicable.

### PART 2 - PRODUCTS

#### 2.01 PIPE HANGERS AND SUPPORTS

- A. Combination clevis hanger.
- B. Pipe hangers: Height adjustable standard duty clevis type, with cross bolt and nut.
  1. Swivel ring type hangers will be allowed for sprinkler piping up to a maximum of 2 inches in size.
- C. Adjustable Floor Rests and Base Flanges: Steel.
- D. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two nuts at each end for positioning rod and hanger, and locking each in place.
- E. Riser Clamps: Malleable iron or steel.

#### 2.02 ANCHORS AND ATTACHMENTS

- A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN, HN, or FS Series.
- B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS Series.

- C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips S Series.
- D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.
- E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS Series.
- F. Beam Clamps: Forged steel beam clamp, with weldless eye nut (right hand thread), steel tie rod, nuts, and washers, Grinnell's Fig No. 292 (size for load, beam flange width, and rod size required).
- G. Metal Deck Ceiling Bolts: B-Line Systems' Fig. B3019.

## 2.03 FASTENERS

- A. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

## 2.04 SHOP PAINTING AND PLATING

- A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with metal primer paint.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Do not hang or support one pipe from another or from ductwork.
  - 1. Do not bend threaded rod.
- B. Support all insulated horizontal piping conveying fluids below ambient temperature, by means of hangers or supports with insulation shields installed outside of the insulation.
- C. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.

### 1. For Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1 and under	8
1-1/4 and 1-1/2	9
2	10
2-1/2 and up	12

2. For Grooved End Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1-1/2 and under	7
2 through 4	10
5 and over	12

a. No pipe length shall be left unsupported between any two coupling joints.

3. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
4. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
5. For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
6. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

D. Minimum Hanger Rod Size: Increase hanger rod size as required to meet requirements of seismic restraint system.

PIPE OR TUBING SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	PIPE	TUBING	PIPE	TUBING
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	1/2	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	3/4	1/2	5/8	1/2
8, 10 and 12	7/8	5/8	3/4	5/8

1. Secure hanger rods as follows: Install one nut under clevis, angle or steel member; one nut on top of clevis, angle or steel member; one nut inside insert or on top of upper hanger attachment and one nut and washer against insert or on lower side of upper hanger attachment. A total of four nuts are required for each rod, two at upper hanger attachment and two at hanger.

E. Vertical Piping:

1. Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
2. Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.

### 3.02 UPPER HANGER ATTACHMENTS

A. General:

1. Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.
2. Do not attach hangers to steel decks that are not to receive concrete fill.
3. Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.
4. Do not use flat bars or bent rods as upper hanger attachments.

B. Attachment to Wood Construction: Secure hangers to the sides (only) of wood members, by means of malleable iron side beam connectors, or malleable iron or steel side beam brackets. Do not secure hanger attachments to nailing strips resting on top of steel beams.

1. Secure side beam connectors to wood members with two No. 18 x 1-1/2 inch long wood screws, or two No. 16 x 1-1/2 inch long drive screws. Do not support piping over 1-1/2 inches in size from side beam connectors. Do not hammer in wood screws.
2. Secure side beam brackets to wood members with steel bolts or lag screws. Do not use lag screws in wooden members having a nominal thickness (beam face) less than 2 inches in size. Install bolts or lag screws, in the sides of a timber or a joist, at the mid-point or above, not less than 2-1/2 inches from the lower edge when supporting branch lines and not less than 3 inches from the lower edge when supporting mains. Install heavy gage steel washers under all nuts.
3. Secure side beam brackets to wooden beams or joists, with lag screws or bolts of size as follows:

PIPE SIZE (Inches)	LAG SCREW SIZE (Inches)	BOLT DIAMETER (Inches)
2 and under	3/8 diameter x 1-3/4	3/8
2-1/2 and 3	1/2 diameter x 2	1/2
4 and 5	Use Bolt	5/8

- a. Do not support piping larger than 3 inches with lag screws. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.
  - b. The minimum width of the lower face of wood beams or joints in which lag screws of size as specified may be used is as follows:
4. Do not secure hanger attachment to the diagonals or vertical members of the trusses.

END OF SECTION 210529





## SECTION 211300 – SPRINKLER AND STANDPIPE PIPING

### PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Through Penetration Firestops: Section 078400.
- B. Sealants: Section 079200.

#### 1.02 REFERENCES

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- B. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

#### 1.03 SUBMITTALS

- A. Product Data:
  - 1. Catalog sheets and specifications indicating manufacturer name, type, applicable reference standard, schedule, or class for specified pipe and fittings.
  - 2. Material Schedule: Itemize pipe and fitting materials for each specified application in Pipe and Fittings Schedule in Part 3 of this Section. Where optional materials are specified indicate option selected.

### PART 2 - PRODUCTS

#### 2.01 STEEL PIPE AND FITTINGS

- A. Steel Pipe for Threading: Standard weight, Schedule 40, black or galvanized; ASTM A 53 or ASTM A 135.
- B. Steel Pipe for Roll Grooving: Standard weight, Schedule 10 or 40, black or galvanized; ASTM A 53, Grade B, Type F for sizes 1-1/4 inch to 1-1/2 inch, and Type E or S for sizes 2 inch to 24 inch, or ASTM A 135.
- C. Cast Iron Fittings:
  - 1. Drainage Pattern, Threaded: ASME B16.12.
  - 2. Steam Pattern, Threaded: ASME B16.4.
    - a. Standard Weight: Class 125.
    - b. Extra Heavy Weight: Class 250.
  - 3. Flanged Fittings and Threaded Flanges: ASME B16.1.
    - a. Standard Weight: Class 125.
    - b. Extra Heavy: Class 250.
- D. Unions: Malleable iron, 250 lb class, brass to iron or brass to brass seats.

- E. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.
- F. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.
- G. Steel Press-Connect Flanges:
  - 1. Pressure Rating: UL 213, FM Global-approved, 175 psig.
  - 2. Flanges: Steel housing, rubber EPDM O-rings, and pipe stop; for use with fitting manufacturer's pressure-seal tools.
  - 3. Class 150, carbon steel; raised-face flangeds with full-face gaskets.
- H. Steel Press Connect Fittings:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LC; MegaPress fittings
  - 2. Pipe: Black steel pipe shall conform to [ASTM 153] [ASTM A135] [ASTM A795] [ASTM A106]. Pipe schedule (pipe wall thickness) shall conform to the standard referenced dimensions for Schedule 10 to Schedule 40.
  - 3. Pressure Rating: UL 213, FM Global-approved, 175-psig.
  - 4. Press-Connect Mechanical Joint Fitting: ASTM A420 or ASME B16.3 and IAPMO PS117 or ICC LC 1002.
  - 5. Sealing Element and Pipe Stops: EPDM or FKM; factory installed or an alternative supplied by fitting manufacturer.
  - 6. Press Ends: Unpressed fitting identification feature to the fitting wall.
  - 7. Pipe Threads: ASTM B16.3.
  - 8. Hangers and Supports: MSS SP 58.
  - 9. Tools: Manufacturer's special tool.

## 2.02 DUCTILE IRON PIPE AND FITTINGS

- A. Water Pipe: Bitumin coated and cement-mortar lined; AWWA C151.
  - 1. 3 and 4 Inch Sizes: Class 51.
  - 2. 6 inch Size and Over: Class 50.
- B. Fittings: Bitumin coated and cement-mortar lined; AWWA C110.

## 2.03 COUPLINGS AND FITTINGS FOR GROOVED END PIPE

- A. Couplings: Victaulic Co.'s FireLock EZ Style 009H or equal.
- B. Fittings: By same manufacturer as couplings, having pressure ratings equal to or greater than couplings. Comply with the following standards:
  - 1. Steel: ASTM A 53 or A 106, Grade B.
  - 2. Malleable Iron: ASTM A 47.
  - 3. Ductile Iron: ASTM A 536.

#### 2.04 VICTAULIC MECHANICAL COUPLINGS FOR JOINING CARBON STEEL PIPE

- A. Victaulic Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic.
  - 1. Rigid Type:
    - a. "Installation Ready" rigid joints shall be Victaulic FireLock® EZ Style 109 [cULus, FM] and 107N [cULus], in sizes 1-1/4"(DN32) through 4" Style 009N in sizes 5" through 12" (DN300.). Designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling.
    - b. Coupling housing 1 1/4" through 4" shall consist of one bolt and one linkage. Linkage shall be constructed of CrMo Alloy Steel, zinc electroplated per ASTM B633 Fe/Zn 5, Type III Finish
    - c. Coupling housings 5" through 12" shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.
    - d. Rigid couplings shall require visual pad-to-pad verification of complete installation. Tongue and recess type couplings which require the use of a torque wrench to achieve the exact required gap between housings are not permitted.
- B. Mechanical Coupling Gaskets: Pressure-responsive, synthetic rubber listed for use with the housings.
- C. Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741 or 744 [UL, ULC, FM]. For mating to ANSI Class 300 flanges use Victaulic Style 743 [UL, ULC, FM].

#### 2.05 INSTALLATION-READY™ FITTINGS FOR FIRE PROTECTION SYSTEMS

- A. Installation-Ready™ fittings for grooved end steel piping in fire protection applications sizes NPS 1-1/4 thru 2 1/2 (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, [orange enamel coated] [red enamel coated] [galvanized]. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).

1. Fittings shall have a shorter center-to-end dimensions for installation in tight spaces.
  2. Fittings are rigid, for direct stab installation without field disassembly.
  3. Installation-Ready™ Fittings shall be Victaulic FireLock® Style 101, Style 102, and style 103, which shall be designed for direct “stab” installation onto grooved pipe without prior disassembly of the fitting.
  4. Fittings shall require visual pad-to-pad verification of complete installation.
  5. Fitting Gaskets: Pressure-responsive, synthetic rubber listed for use with the housings.
- B. In lieu of threaded steel piping systems, the Victaulic FireLock IGS System with “Installation-Ready™ fittings and couplings may be used for NPS 1 (DN 25) Schedule 10 and Schedule 40 carbon steel pipe in fire protection applications. System rated for a working pressure to 365 psi (2517 kPa).
1. Groove: IGS “Innovative Groove System” groove with shortened “A” dimension and tapered groove backside for ease of installation.
  2. Grooving Tool: Victaulic RG2100, with IGS Confirmation Gauge.
  3. Fittings: Ductile iron housing conforming to ASTM A-536, Grade 65-45-12. Orange enamel coated or galvanized.
    - a. Victaulic Style 101 (90-degree elbow), Style 102 (tee), and Style 108 (coupling) with Installation-Ready™ ends.
    - b. Style 108 single-bolt coupling provided with EPDM Type A pressure responsive gasket with Vic-Plus lubricant, and ASTM A449 compliant electroplated steel bolt and nut. CrMo alloy steel coupling linkage.
- C. UL listed and FM approved rigid coupling to join sprinklers with IGS profile grooved ends to matching 1” IGS outlets; Coupling consists of two cast copper-alloy housing segments for connection of ½”, ¾”, and 1” sprinklers. Coupling includes an EPDM Type A gasket, with zinc-plated cap screws conforming to ASTM F835, and nylon insert locknut. Installation-ready, for direct push installation without field disassembly. Rated for a working pressure to 175 psi (1205 kPa).
1. Fully installed at visual pad-to-pad contact with no required torque rating.
- 2.06 COUPLINGS AND FITTINGS FOR 1 INCH NOMINAL DIAMETER GROOVED END PIPE
- A. Manufacturer: Victaulic® FireLock™ Innovative Groove System (IGS)
1. No. 142 Welded Outlet
  2. Style 922 Outlet-T
  3. Style 920N Mechanical-T Outlet
  4. No. 101 Installation-Ready™ 90° Elbow

5. Style 108 Installation-Ready™ Rigid Coupling
  6. No. 102 Installation-Ready™ Tee
  7. No. 148 Sprinkler Reducer, NPT or BSPT sprinkler outlet
  8. No. 143 Close Nipple
  9. No. 145 Female NPT or BSPT Threaded x Groove 90° Elbow
  10. No. 146 Cap
  11. No. 140 Male NPT or BSPT Threaded x Groove Adapter
  12. No. 141 Female NPT or BSPT Threaded x Groove Adapter
  13. RG2100 Roll Grooving Tool
  14. VicFlex™ Series AH2-CC Braided Flexible Hose with Captured Coupling
- B. Available Sizes: 1 inch
- C. Pipe Material:
1. Carbon steel, Schedule 40.
- D. Maximum Working Pressure:
1. Up to 365 psi.
- E. Pipe Preparation:
1. Cut or roll grooved in accordance with publication: Vitaulic IGS Specifications.
- F. Product shall be UL Listed and FM Approved.
- G. Housing: Ductile iron conforming to ASTM A536, Grade 65-42-12
- H. Grade “E” EPDM Type A Vic-Plus™ Gasket System
1. EPDM (Violet color code). FireLock products have been Listed by UL LLC and Approved by FM Approvals LLC for fire sprinkler services up to the rated working pressure using the Grade “E” Type A Vic-Plus™ Gasket System, requiring no field lubrication for most installation conditions.
- I. Bolts/Nuts:
1. Standard: Carbon steel oval neck track bolts meeting the mechanical property requirements of ASTM A449 (imperial) and ISO 898-1 Class 9.8 (metric). Carbon steel hex nuts meeting the mechanical property requirements of ASTM A563 Grade B (imperial – heavy hex nuts) and ASTM A563M Class 9 (metric – hex nuts). Track bolts and hex nuts are zinc electroplated per ASTM B633 FE/Zn 5, finish Type III (imperial) or Type II (metric).

- J. Coupling Linkage: CrMo Alloy Steel zinc electroplated per ASTM B633 Re/Zn 5, Type III Finish.
- K. No. 140, 141, 142, 143, 148: Carbon Steel meeting the chemical and mechanical property requirements of ASTM A53 Grade A.
- L. No. 145, 146: Ductile iron conforming to ASTM A536, Grade 65-45-12
- M. Victaulic FireLock™ IGS Installation-Ready™ Style V9 Coupling
  - 1. UL listed and FM approved rigid coupling to join sprinklers with IGS profile grooved ends to matching 1" IGS outlets; Coupling consists of two cast copper-alloy housing segments for connection of ½", ¾", and 1" sprinklers. Coupling includes an EPDM Type A gasket, with zinc-plated cap screws conforming to ASTM F835, and nylon insert locknut. Installation-ready, for direct push installation without field disassembly. Rated for a working pressure to 175 psi (1205 kPa).
    - a. Groove: IGS "Innovative Groove System" groove with shortened "A" dimension and tapered groove backside for ease of installation.
      - 1) Grooving Tool: Victaulic RG2100, with IGS Confirmation Gauge.
    - b. Fully installed at visual pad-to-pad contact with no required torque rating.

## 2.07 BOLTED MECHANICAL BRANCH CONNECTION

- A. Victaulic Co.'s 920 Mechanical T.

## 2.08 JOINING AND SEALANT MATERIALS

- A. Thread Sealant:

- 1. LA-CO Industries' Slic-Tite Paste with Teflon.
- 2. Loctite Corp.'s No. 565 Thread Sealant.
- 3. Thread sealants for potable water shall be NSF approved.

- B. Joint Packing:

- 1. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504) 466-1484.

- C. Gaskets For Use With Ductile Iron Water Pipe: Synthetic rubber rings (molded or tubular): Clow Corp.'s Belltite, Tyler Pipe Industries Inc.'s Ty-Seal, or U.S. Pipe and Foundry Co.'s Tyton.

- D. Flange Gasket Material:

- E. Gaskets For Use With Grooved End Pipe and Fittings:

- F. Anti-Seize Lubricant: Bostik Inc.'s Never Seez or Dow Corning Corp.'s Molykote 1000.

## 2.09 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

- A. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504)466-1484.

## 2.10 PIPE SLEEVES

- A. Type A: Schedule 40 steel pipe.
- B. Type B: No. 16 gage galvanized sheet steel.
- C. Type D: No. 16 gage galvanized sheet steel with 16 gage sheet steel metal collar rigidly secured to sleeve. Size metal collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening thru the metal deck.

## 2.11 FLOOR, WALL AND CEILING PLATES

- A. Cast Brass: Solid type with polished chrome plated finish, and set screw.
  - 1. Series Z89 by Zurn, 929 Riverside Drive, Grosvonordale, CT 06255, (800) 243-1830.
  - 2. Model 127XXXX by Maguire Mfg., Cheshire CT 06410, (203) 699-1801.
- B. Stamped Steel: Split type, polished chrome plated finish, with set screw.
  - 1. Figures 2 and 13 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.
- C. Cast Iron or Malleable Iron : Solid type, galvanized finish, with set screw:
  - 1. Model 395 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.
  - 2. Model 900-016XX by Landsdale International, Westville, NJ 08093, (800) 908-0523.

## 2.12 IN-LINE CORROSION MONITOR FOR WET AND DRY PIPE FIRE SPRINKLER SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AGF Manufacturing Inc.; CORrinSITE™ Model 7800 or equivalent.
- B. Standards:
  - 1. UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 2. NFPA 13 and NFPA 25.
- C. Specifications:
  - 1. Service Pressure: 300 PSI.

2. Operating Temp.: -40° to 200° F.
  3. Material: Mild Carbon Steel.
  4. Wear Dimension: 0.040 inch.
  5. Sizes: [2] [2-1/2] [3] [4] [6] [8] inches.
  6. Schedule [10] [40].
  7. For Black and Galvanized Pipe.
- D. Model 7800 is offered in a Mechanical Tee versions
- E. Finishes:
1. Powder-coat.
    - a. Color: Red.
  2. Hot-dip galvanized.
- 2.13 SYSTEM TEST AND DRAIN CONNECTION WITH PRESSURE RELIEF VALVE FOR RISER RETROFITS
- A. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AGF Manufacturing Inc.; Model 1011T TESTanDRAIN.
  2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing. NFPA 13, 13R, 13D (as applicable).
  3. Pressure Rating: 300 psig (2070 kPa).
  4. Body Material: Bronze body, brass stem, impregnated Teflon seat, chrome coated brass ball, and a steel handle with positive stops at the TEST and DRAIN positions
  5. Components: A tamper resistant test orifice, integral tamper resistant sight glasses, a tapped and plugged port for system access, and a steel identification plate.
  6. Test Orifice Size: Nominal [3/8 inch (2.8K)][7/16 inch (4.2K)][1/2 inch (5.6)][17/32 inch (8.0)][5/8 inch (11.2K, ELO)][3/4 inch (14.0K, ESFR)][K25], as required by NFPA 13, latest edition.
  7. Pressure Relief Valve and Drainage Piping: AGF Model 7000
    - a. Pressure Rating: Factory rated at 175 PSI. Other pressure settings available: [165 PSI] [185 PSI] [195 PSI] [205 PSI], [225 PSI] [250 PSI].
    - b. Body Material: Bronze body and stainless steel spring
    - c. Components: Nylobraid flexible tube, Two 1/2" NPT by barbed 90 degree elbows, external identification plate and integral flushing handle to remove debris



- d. ½ inch MIPT inlet, ½ inch FIPT outlet
  - e. Relief pressure shall be factory set to project specifications
  - f. Relief valve shall operate to the OPEN position between 90% and 105% of the set pressure
  - g. Relief valve shall reseal or CLOSE at a minimum of 80% of set pressure.
- 8. Pressure Gauge: AGF Model 7500.
  - 9. Globe Valve: AGF Model 7600.
  - 10. Size: Same as connected piping.
  - 11. Inlet and Outlet: Threaded.
  - 12. Locking Plate Kit (Optional): Provides vandal resistance and prevents accidental alarm activation by locking the valve handle in the "OFF" position.
    - a. Locking Plate: Carbon steel.
    - b. Lock: 1-1/2 inch wide solid brass with a 3/8 inch chrome plated hardened steel shackle.
    - c. For use with a [3/4 inch] [1 inch] [1-1/4 inch] [1-1/2 inch] [2 inch] valve.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install piping at approximate locations indicated, and at maximum height.
- B. Install piping clear of door swings, and above sash heads.
- C. Make allowances for expansion and contraction.
- D. Allow for a minimum of one inch free air space around pipe or pipe covering, unless otherwise specified.
- E. Install horizontal piping with a constant pitch, and without sags or humps.
- F. Install vertical piping plumb.
- G. Use fittings for offsets and direction changes.
- H. Cut pipe and tubing ends square; ream before joining.
- I. Threading: Use American Standard Taper Pipe Thread Dies.
- J. All fire caulks, acoustical sealants, sleeve assemblies, heat tape, pre-formed foam insulation, thread sealants, etc... shall be reviewed with the appurtenance manufacturer and with the FBC System Compatible program, refer to paragraph 1.04 above for further instructions.

### 3.02 FIRE SPRINKLER AND FIRE STANDPIPE PIPING SYSTEM

- A. Install piping to be completely drainable.

### 3.03 PIPE JOINT MAKE-UP

- A. Threaded Joint: Make up joint with a pipe thread compound applied in accordance with manufacturer's printed application instructions for the intended service.
- B. Flanged Pipe Joint:
1. Install threaded companion flanges on steel pipe; flanges on galvanized pipe are not required to be galvanized.
  2. Provide a gasket for each joint.
  3. Coat bolt threads and nuts with anti-seize lubricant before making up joint.
- C. Rubber Ring Push-on Joint: Clean hub, bevel spigot, and make up joint with lubricated gasket in conformance with the manufacturer's printed installation instructions.
- D. Grooved Pipe Joint: Roll groove pipe ends, make up joint with grooved end fittings and couplings, in conformance with the manufacturer's printed installation instructions.
1. Cut grooved end piping is not acceptable.
- E. Mechanical Joint: Make up joint in conformance with the manufacturer's printed installation instructions, with particular reference to tightening of bolts.
- F. Steel-Piping, Press-Connect Joints: Join Schedule 10 or Schedule 40 black steel pipe and carbon steel press-connect fittings.
1. Ream and remove burrs from pipe ends.
  2. Prepare pipe surface per manufacturer's installation instructions.
  3. Mark proper insertion depth prior to making press connection.
  4. Use tool and jaw/rings recommended by fitting manufacturer.

### 3.04 PIPING PENETRATIONS

- A. Sleeve Schedule: Unless otherwise shown, comply with the following schedule for the type of sleeve to be used where piping penetrates wall or floor construction:

	CONSTRUCTION	SLEEVE TYPE
1	Frame construction	None required
2	Foundation walls	A*
3	Non-waterproof interior walls	B*
4	Non-waterproof interior floors on metal decks	D*
5	Non-waterproof interior floors not on metal decks	B*
6	Floors not on grade having a floor drain	A
7	Floors over mechanical equipment, steam service, machine, and boiler rooms	A

8	Floors finished or to be finished with latex composition or terrazzo, and on metal decks	D*
9	Floors finished or to be finished with latex composition or terrazzo, and not on metal decks	A
10	Earth supported concrete floors	None required
11	Exterior concrete slab on grade	A
12	Fixtures with floor outlet waste piping	None required
13	Metal roof decks	C
14	Non-metal roof decks	A
15	Waterproof floors on metal decks	D
16	Waterproof floors not on metal decks	A
17	Waterproof walls	A

\*Core drilling is permissible in lieu of sleeves where marked with asterisks.

B. Diameter of Sleeves and Core Drilled Holes:

1. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.

C. Length of Sleeves (except as shown otherwise on Drawings):

1. Walls and Partitions: Equal in length to total finished thickness of wall or partition.
2. Floors, Finished: Equal in length to total finished thickness of floor and extending 1/2 inch above the finished floor level, except as follows:
  - a. In furred spaces at exterior walls, extend sleeve one inch above the finished floor level.
3. Exterior Concrete Slabs: Equal in length to total thickness of slab and extending 1/2 inch above the concrete slab.
4. Roofs: Equal in length to the total thickness of roof construction, including insulation and roofing materials, and extending one inch above the finished roof level.

D. Packing of Sleeves and Core Drilled Holes:

1. Unless otherwise specified, pack sleeves or cored drilled holes in accordance with Section 078400 - FIRESTOPPING.

3.05 FLOOR, WALL AND CEILING PLATES

A. Install plates for exposed uninsulated piping passing thru floors, walls, ceilings, and exterior concrete slabs as follows:

1. Piping 2 Inch Size and Smaller In Finished Spaces:
  - a. Solid Type: Chrome plated cast brass construction with set screw.
  - b. Split Type: Chrome plated stamped steel construction with set screw.
2. Piping over 2 inch size In Finished Spaces, and Piping in Unfinished Spaces:
  - a. Solid Type: Galvanized cast iron construction with set screw.

- b. Split Type: Chrome plated stamped steel construction with set screw.
- 3. Piping in Unfinished Spaces (Including Exterior Concrete Slabs): Solid type, galvanized, cast iron or malleable iron construction.
- 4. Fasten plates with set screws.
- 5. Plates are not required in pipe shafts or furred spaces.

### 3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections [with the assistance of a factory-authorized service representative]:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance Chapter."
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Coordinate with fire-pump tests. Operate as required.
  - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.07 PIPE AND FITTING SCHEDULE

- A. Where options are given, choose only one option for each piping service. No deviations from the selected option will be allowed.
- B. Fire Standpipe and Sprinkler:
  - 1. Standard weight black steel pipe, with roll grooved ends, grooved pipe fittings or carbon steel press connect fittings, and couplings.
  - 2. Standard weight black steel pipe, with standard weight cast iron fittings, and threaded joints.

END OF SECTION 211300

## SECTION 211313 – SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting: Section 099103.
- B. Backflow Preventers: Section 210524.
- C. Hangers and Supports: Section 210529.
- D. Sprinkler Piping: Section 211300.

#### 1.02 REFERENCES

- A. NFPA 13 - National Fire Protection Association Standard for the Installation of Sprinkler Systems.

#### 1.03 SYSTEM DESCRIPTION

- A. Type of System:
  - 1. Wet System – Hydraulically Designed System.
- B. Occupancy Classification:
  - 1. Light Hazard Occupancy.
  - 2. Ordinary Hazard Occupancy.

#### 1.04 SUBMITTALS

- A. Fire Protection Engineer Qualification:
  - 1. Where required by this specification or the project drawings to provide the services of a professional engineer, the professional engineer shall be a licensed Fire Protection Engineer, who is actively licensed in the State which the work is being performed in.
  - 2. A licensed Fire Protection Engineer shall be defined as a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES). No substitutions of alternates shall be accepted.
- B. Shop Drawings:
  - 1. Complete sprinkler system layout in accordance with NFPA-13.
  - 2. Hydraulic calculations shall be complete and cross referenced to the appropriate drawing sheets.

3. Hydraulic calculations shall be complete and cross referenced to the appropriate drawing sheets. Hydraulic calculations shall be prepared using one of the following programs (NO EXCEPTIONS):
    - a. HydraCAD
    - b. AutoSprink
    - c. SprinkCAD
  4. The shop drawings shall be developed by and the hydraulic calculations shall be performed by person(s) meeting one of the following minimum qualification levels (without substitution):
    - a. National Institute for Certification in Engineering Technologies (NICET) Level III for Water-Based Fire Protection Systems certified technicians,  
OR
    - b. National Institute for Certification in Engineering Technologies (NICET) Level IV for Water-Based Fire Protection Systems certified technicians,  
OR
    - c. A licensed Professional Engineer, licensed in the State of New York, who has licensed by exam (Principles of Practice of Fire Protection Engineering Exam).
- C. Product Data: Catalog sheets, specifications, and installation instructions. Indicate UL or FM approval for each product. Include the following additional information:
1. Electrical Devices: Complete description of intended use, wiring diagrams, data plate information and, in the case of switching devices, whether normally on, or normally off. Include motor test data.
  2. Mechanical Devices: Complete description of intended use, including normal operating capacities and working pressures.
  3. Enclosures: Dimensions, materials, gages of metals; type of door hinges and locks, and methods of securing the enclosure members to the building construction.
  4. Hose Threads: Verify that hose threads on fire department connections match threads on equipment used by the local or servicing fire department.
- D. Quality Control Submittals:
1. Design Data: The portions of the sprinkler system not sized on the Contract Drawings shall be sized in accordance with NFPA requirements for Hydraulically Designed Systems. Submit drawings and hydraulic calculations for approval.
  2. Certificates: As required under Quality Assurance Article.
  3. Company Field Advisor Data: Include:
    - a. Name, business address and telephone number of Company Field Advisor secured for the required services.
    - b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
    - c. Services and each product for which authorization is given by the Company, listed specifically for this project.
    - d. Copy of:
      - 1) NICET Letter of Approval of supervisor indicating Level III for Water-Based Fire Protection Systems certification OR

- 2) NICET Letter of Approval of supervisor indicating Level IV for Water-Based Fire Protection Systems certification OR
  - 3) Licensure certificate for Professional Engineering in the State of New York, AND National Council of Examiners for Engineering and Surveying (NCEES) record/certificate for verification of completion of the Principles of Practice of Fire Protection Engineering Exam.
4. Contractor's Qualifications Data:
- a. Contractor's name, business address and telephone number.
  - b. Names and addresses of 3 similar projects that each person has worked on during the past 5 years.
  - c. Name of Project Manager for the project that is National Institute for Certification in Engineering Technologies (NICET) certified as Level III or IV for Water-Based Fire Protection Systems, or is a registered Professional Engineer in the State of New York. Provide a copy of Project Manager's:
    - 1) NICET Letter of Approval indicating Level III for Water-Based Fire Protection Systems certification, OR
    - 2) NICET Letter of Approval indicating Level IV for Water-Based Fire Protection Systems certification, OR
    - 3) Licensure certificate for Professional Engineering in the State of New York, AND National Council of Examiners for Engineering and Surveying (NCEES) record/certificate for verification of completion of the Principles of Practice of Fire Protection Engineering Exam.
5. Installer's Qualifications Data:
- a. Name of each person who will be performing the Work and their employer's name, business address and telephone number.
  - b. Names and addresses of 3 similar projects that each person has worked on during the past 5 years.
6. Working Drawing/Hydraulic Calculation Preparer Qualification Data:
- a. Working drawings and hydraulic calculations shall be prepared by either a:
    - 1) National Institute for Certification in Engineering Technologies (NICET) certified as Level III for Water-Based Fire Protection Systems technician.
    - 2) National Institute for Certification in Engineering Technologies (NICET) certified as Level IV for Water-Based Fire Protection Systems technician.
    - 3) A licensed Professional Engineer, licensed in the State of New York, who has licensed by exam (Principles of Practice of Fire Protection Engineering Exam).
  - b. Name of each person who will be preparing working drawings/hydraulic calculations required for the Work.
  - c. Upon request, furnish names and addresses of the required number of similar projects that each person has worked on which meet the experience criteria.
  - d. Copy of:
    - 1) NICET Letter of Approval indicating Level III for Water-Based Fire Protection Systems certification, OR
    - 2) NICET Letter of Approval indicating Level IV for Water-Based Fire Protection Systems certification, OR

- 3) Licensure certificate for Professional Engineering in the State of New York, AND National Council of Examiners for Engineering and Surveying (NCEES) record/certificate for verification of completion of the Principles of Practice of Fire Protection Engineering Exam.

7. All of the above Qualifications Data shall be submitted with Contractor's bid package and with shop drawings.

E. Contract Closeout Submittals:

1. Operation and Maintenance Data. Deliver 2 copies to the Owner's Representative:
  - a. Instruction manual describing the operation and maintenance of the system.
  - b. Parts list for each mechanical and electrical device.
  - c. Publication NFPA 25, Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.

1.05 QUALITY ASSURANCE

- A. Company Field Advisor with qualifications identified above. Secure the services of a Company Field Advisor for the following:
  1. Render advice regarding installation and final adjustment of the system.
  2. Witness final system test and then certify with an affidavit that the system is installed in accordance with the contract documents and is operating properly.
  3. Train facility personnel in operation, and routine maintenance of the system.
  4. The Company Field Advisor shall be:
    - a. National Institute for Certification in Engineering Technologies (NICET) Level III for Water-Based Fire Protection Systems certified technicians, OR
    - b. National Institute for Certification in Engineering Technologies (NICET) Level IV for Water-Based Fire Protection Systems certified technicians, OR
    - c. A licensed Professional Engineer, licensed in the State of New York, who has licensed by exam (Principles of Practice of Fire Protection Engineering Exam).
- B. Contractor Qualifications: The Contractor performing the Work of this Section shall be experienced in sprinkler Work and shall have been regularly engaged in the installation of sprinkler systems for a minimum of 10 years and shall, upon request, furnish to the Owner's Representative the names and addresses of 5 similar projects which the Contractor worked on during the last 5 years.
  1. The Project Manager employed to supervise the Work shall be National Institute for Certification in Engineering Technologies (NICET) certified as Level III or IV for Water-Based Fire Protection Systems, OR shall be a Professional Engineer licensed in the State of New York who has licensed by exam (Principles of Practice of Fire Protection Engineering Exam). The services of a Project Manager shall include but not limited to the following:
    - a. Attendance at meetings during construction.



- b. Render advice regarding installation and final adjustment of the system.
  - c. Witness final system test and then certify with an affidavit that the system is installed in accordance with the contract documents and is operating properly.
  - d. Performance of hydraulic calculations and development of Working Drawings.
- C. Installer Qualifications: The workers and supervisors performing the Work of this Section shall be personally experienced in sprinkler systems Work and shall have been regularly employed by a company engaging in the installation of sprinkler systems for a minimum of 5 years and shall, upon request, furnish to the Owner's Representative the names and addresses of 5 similar projects which they have worked on during the last 5 years.
- D. Working Drawing/Hydraulic Calculation Preparer Qualifications:
  - 1. The persons employed to prepare these documents for the Work shall be personally experienced in sprinkler work and shall have been regularly performing such work for a minimum of 5 years while in the employ of a company or companies engaged in the installation of fire protection systems.
    - a. Upon request, furnish to the Owner's Representative the names and addresses of five similar projects which the foregoing people have prepared working drawings/hydraulic calculations on during the past 3 years.
    - b. The persons employed to prepare these documents for the Work shall be performed by person(s) meeting one of the following minimum qualification levels (without substitution):
      - 1) National Institute for Certification in Engineering Technologies (NICET) Level III for Water-Based Fire Protection Systems certified technicians, OR
      - 2) National Institute for Certification in Engineering Technologies (NICET) Level IV for Water-Based Fire Protection Systems certified technicians, OR
      - 3) A licensed Professional Engineer, licensed in the State of New York, who has licensed by exam (Principles of Practice of Fire Protection Engineering Exam).
- E. System Acceptance:
  - 1. Comply with NFPA 13 requirements.
  - 2. Complete and sign the Contractor's Material and Test Certifications and provide copies to Owner's Representative.
  - 3. Tests shall be witnessed by the Owner's Representative.
- F. Regulatory Requirements:
  - 1. Materials for the Work of this Section shall be Underwriter's Laboratories listed, and/or Factory Mutual approved.
- G. Certification: NFPA Contractor's Material and Test Certificate.

#### 1.06 MAINTENANCE

- A. Spare Parts: Furnish the following items and deliver to the Owner's Representative for storage in spare sprinkler head cabinets:
  - 1. Spare sprinkler heads per NFPA-13.
  - 2. One sprinkler head wrench to fit each type sprinkler head listed above.

## PART 2 - PRODUCTS

### 2.01 VALVES AND ACCESSORIES

- A. Gate Valves (175 psig non-shock working pressure):
  - 1. 3/4 inch to 2 inch: Bronze body, OS & Y indicating type; double or wedge disc with threaded ends.
  - 2. 2-1/2 inch and larger: IBBM, OS & Y indicating type; double or wedge disc with end connections as required to suit the piping system.
- B. Check Valves: IBBM, single clapper swing check with metal to metal or rubber faced checks, suitable for horizontal and vertical installation; end connections as required to suit the piping system; 175 psig non-shock working pressure.
  - 1. Ball Drip (where shown on Drawings): Brass, automatic; threaded on both ends.

### 2.02 FIRE SPRINKLERS AND APPURTENANCES

- A. Fire Sprinklers: Provide sprinkler types as listed on the Construction Drawings.
  - 1. Acceptable Manufacturers:
    - a. Globe
    - b. Vitaulic
    - c. Reliable
    - d. Viking
    - e. Tyco
- B. Sprinkler Guards For Exposed Piping: Welded steel wire cage with cast or pressed steel base plate and suitable retaining clamps.
  - 1. Finish: Paint to match sprinkler piping.
- C. Spare Sprinkler Head Cabinet: Steel, with hinged cover, constructed of minimum 20 gage material and fitted with 16 gage steel racks designed to hold quantities and types of spare sprinkler heads and sprinkler head wrenches.
  - 1. Finish: Bright red, baked on enamel.
- D. Where concealed pendent or sidewall sprinklers are provided, Contractor shall provide cover plates which are factory painted to match the ceiling or wall color in which the sprinkler is installed. Contractor shall confirm the colors of all walls and ceilings with Architect and Owner's Representative prior to submitting proposal.

- E. Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108] shall be used to locate sprinklers as required by final finished ceiling tiles and walls. The factory tested drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread with installed sprinkler head.
1. Captured Coupling IGS Groove Style 108 single-bolt coupling provided with EPDM Type A pressure responsive gasket with Vic-Plus lubricant, and ASTM A449 compliant electroplated steel bolt and nut. CrMo alloy steel coupling linkage.
  2. The drop shall include a UL approved Series AH1 with 3" bend radius; AH2 or AH2-CC braided hose with a bend radius to 2" to allow for proper installation in confined spaces. The hose shall be listed for [(4) bends at 31" length] [(5) bends at 36" length] [(8) bends at 48" length] [(10) bends at 60" length] [(12) bends at 72" length].
  3. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place. The braided drop system is UL listed for sprinkler services to 175 psi (1206 kPa) and FM Approved to 200 psi (1380 kPa).
    - a. All hoses shall be factory-pressure tested to 400 psi. (2760 kPa).
    - b. AB6 Bracket Assembly, for use in cold storage applications with Victaulic Model V36 dry sprinklers.
    - c. Approvals:
      - 1) FM-1637
      - 2) UL 2443
    - d. Refer to the Victaulic I-VICFLEX installation manual and the Victaulic VicFlex™ Design Guide, as shown in product submittal 10.85 to ensure proper installation.

## 2.03 SIGNS

- A. Steel with vitreous enamel finish, lettering on contrasting background to identify and indicate the function of:
1. Control valves.
  2. Drain, test, air supply and alarm check valves.
  3. Water motor alarm.
  4. Drain and test valves.

## 2.04 AUXILIARY DRAINS

- A. Provide auxiliary drains in accordance with the edition of NFPA-13 adopted by the Local Authorities. At a minimum provide Auxiliary drains in the following locations.
1. Auxiliary Drains for Wet Pipe Systems and Preaction Systems in Areas Not Subject to Freezing.

- a. Where the capacity of isolated trapped sections of pipe is 50 gallons or more, the auxiliary drain shall consist of a valve not smaller than 1 inch, piped to an accessible location.
- b. Where the capacity of isolated trapped sections of pipe is more than 5 gallons and less than 50 gallons, the auxiliary drain shall consist of a valve  $\frac{3}{4}$  inch or larger and a plug or a nipple and cap.
- c. Where the capacity of trapped sections of pipes in wet systems is less than 5 gallons, one of the following shall be provided:
  - 1) An auxiliary drain shall consist of a nipple and cap or plug not less than  $\frac{1}{2}$  inch in size.
  - 2) An auxiliary drain shall not be required for trapped sections less than 5 gallons where the system piping can be drained by removing a single pendent sprinkler.
  - 3) Where flexible couplings or other easily separated connections are used, the nipple and cap or plug shall be permitted to be omitted.
- d. Tie-in drains shall not be required on wet systems and preaction systems processing nonfreezing environments.

**B. Low Point Drain with Water Detection System:**

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AGF Manufacturing Inc.; Model 5100ALBV COLLECTanDRAIN™.
2. Standards:
  - a. UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - b. NFPA 13 and NFPA 25.
3. Components:
  - a. Model 5100BV-SP 1 inch MIPT x FIPT Ball Valve with Side Ports.
  - b. Model 5100AL Water Detection Alarm with Union and Nipple.
    - 1) Powered by a 9-volt battery to operate a red LED visual indicator and a 103 dB beeping alarm which are activated when water is present in the COLLECTanDRAIN™.
    - 2) Battery operated system provides multiple years of service for intermittent alarming or can operate continuously for 72 hours.
    - 3) Unit features a test button to confirm operational integrity, offers left or right side installation, and can be isolated for service or battery replacement.
4. Model 5100 is offered in three versions:
  - a. Model 5100A: Fully Assembled.
  - b. Model 5100K: Field Assembly Kit (includes ball valves, water detection alarm, and Anti-Trip Plate with mounting hardware).
  - c. Model 5100ALBV: 1 inch MIPT x FIPT ball valve with integral water detector.

## **PART 3 - EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Testing Existing System: Prior to installing the new system, test the existing system, as prescribed for new systems in accordance with NFPA 13, to ascertain its operating condition.

1. Prepare a written report for the Owner's Representative indicating the repairs required, if any, to make the existing system function properly.
2. Repairs to the existing system are not included in the Work unless requested by Order on Contract.

### 3.02 PREPARATION

- A. Existing Sprinkler System Shutdown:

1. Before shutting down the sprinkler system to perform the Work, notify the Owner's Representative in writing, and the local fire department that the system is to be shut down temporarily. Give schedule which states date and time of proposed shut down and the approximate length of time that the system will be out of service. Request instructions for precautions that should be taken during the shut down period.
2. Do not shut down the system until schedule is approved by the Owner's Representative.
3. Return the existing system to pre-shutdown operation immediately after the Work has been completed. Give written notice to the Owner's Representative that the system has been returned to pre-shutdown operation.

### 3.03 INSTALLATION

- A. Unless otherwise shown or specified, install the Work of this section in accordance with NFPA 13, and the item manufacturer's installation instructions.

- B. Locking Valves:

1. Lock gate valves in open position with chain looped through handwheel and around adjacent sprinkler pipe. Secure with padlock.

- C. Spare Sprinkler Head Cabinet: Secure to building wall or other permanent structure in vicinity of main valve controlling sprinkler system, unless otherwise directed.

- D. Connection to Existing Main: A bolted mechanical branch connection may be used. Refer to Section 211300.

- E. Signs: Install signs identifying the following:

1. Valves: One for each size, type and function.
2. Water Motor Alarm.
3. Hydraulically Designed System.

- F. Diagram, Maintenance, Inspection Procedure and Charts: Install at location indicated on the Drawings or as directed.

### 3.04 FIELD QUALITY CONTROL

- A. Tests: Unless otherwise shown or specified, perform tests in accordance with NFPA 13.
  - 1. Flushing: In addition to the requirements of the Standard, flush new piping before making final connection to existing systems and before performing hydrostatic test. Flush at rates of flow prescribed in the Contractor's Material and Test Certificate. After making final connections, flush entire system and assure that debris is removed from piping and there are no stoppages or obstructions in the system.
  - 2. System Tests:
    - a. Test all new Work.
    - b. Notify the Owner's Representative when the Work of this Section is ready for testing.
    - c. Perform the tests when directed, and in the Owner's Representatives presence.

END OF SECTION 211313

## SECTION 220000 – PLUMBING SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 22, and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - a. Work covered under Plumbing contract.
  - b. Work under other contracts.
  - c. Use of premises.
  - d. Owner's occupancy requirements.
  - e. Specification formats and conventions.
- B. Related Sections include the following:
  - a. Division 22 Sections.

#### 1.3 WORK COVERED UNDER PLUMBING CONTRACT

- A. Provide all labor, materials, tools, machinery, equipment, and services necessary to complete the plumbing work under this contract. All systems and equipment shall be complete in every respect and all items of material, equipment, and labor shall be provided for a fully operational system. Coordinate the work with work of other trades so as to resolve conflicts without impeding job progress. The plumbing work includes the following:
- B. PLUMBING:
  - 1. Remove existing plumbing fixtures as indicated on plans, complete with all associated flushometers, faucets, piping, valves, cleanouts, traps, fittings, supports, etc.
  - 2. Remove existing domestic water piping (DCW/DHW/DHWR) as called out on the drawings, complete with existing valves, insulation, supports, etc.
  - 3. Remove existing plumbing piping (waste, vent, gas, vacuum, etc.) as called out on the drawings, complete with existing valves, supports, etc.
  - 4. Remove all demolished equipment and debris from the site in accordance with all State and Local regulations.
  - 5. Coordinate all removals as further scheduled on the drawings so as not to interfere with Owner's use of the building.
  - 6. Furnish and install new plumbing fixtures, faucets, piping, valves, strainers, cleanouts, accessories, etc. as specified on plans and in the specifications.

7. Furnish and install new domestic hot water heater, complete with new piping, flue vent & air intake pipe, domestic hot water mixing valve, valves, expansion tank, controls, fittings, etc. as indicated on plans.
8. Furnish and install new grease interceptor, complete with new piping, air fitting, etc. as indicated on plans. Sawcut existing floor slab as required and patch.
9. Furnish and install new domestic water piping (DCW/DHW/DHWR) as indicated on the plans, complete with valves, fittings, hangers, supports, insulation, etc. Connect to existing piping. Coordinate all tie-in connections in field.
10. Furnish and install new waste and vent piping, complete with cleanouts, fittings, hangers and supports. Saw cut existing floor slabs, ceiling, walls and roof as required and patch. Coordinate all slopes and inverts and tie-in connections in field
11. Furnish and install new roof leader/storm piping, complete with cleanouts, fittings, hangers and supports.
12. Furnish and install new gas piping to new HVAC/HV/mechanical equipment, kitchen appliances, domestic hot water heater, etc. as indicated on plans. Coordinate with the local utility company for upgrading of existing gas service and pay for all costs. Provide gas shut off valves and gas pressure regulators as called out on plans. All new gas piping shall be painted with "yellow" color (1 primer and 2 finish coats)
13. Furnish and install new elevator sump pump system with simplex pump, control panel, controls, etc. for a complete and operational system.
14. Furnish and install new condensate drain piping for new HVAC equipment as shown on the drawings, complete with new condensate drain pumps, dry wells, supports, pipe insulation, pipe identifications and flow arrows.
15. Furnish and install new roof drains and associated piping as shown on the drawings.
16. Furnish and install new floor drains, floor sinks, and related piping, and traps.
17. Provide insulation to all domestic water piping (DCW/DHW/DHWR) and roof leader/storm piping. Refer to specification section 220719 for insulation requirements.
18. Provide proper piping supports, hangers, anchors, etc.
19. Provide proper slope to all piping as per latest Plumbing Code and other applicable codes.
20. Pressure-test all piping for any leakage. Repair all leaks and perform testing until no leaks are found.
21. Provide identification tags with flow arrows for all plumbing piping. Provide valve tags for all valves, and provide a valve chart identifying all valve sizes and locations.
22. Furnish and install all ancillary equipment needed for a complete and proper installation including, but not limited to expansion joints, anchors, hangers, fittings, valves, unions, etc.
23. All cutting, patching and alteration work shall be performed.



24. The contractor shall furnish and install all items required for a complete and functioning plumbing system.

#### 1.4 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 USE OF PREMISES

- A. General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - a. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
  - b. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
  - a. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - b. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - a. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

- b. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
- c. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

## 1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.
  - a. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - b. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - a. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - b. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 220000

## SECTION 220501 - BASIC PLUMBING MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Mechanical demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Painting and finishing.
  - 11. Concrete bases.
  - 12. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  1. Transition fittings.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Eclipse, Inc.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Zurn Industries, Inc.; Wilkins Div.
    - e. Or Approved Equal
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Or Approved Equal
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Pipeline Seal and Insulator, Inc.
    - c. Or Approved Equal
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Or Approved Equal
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:

- a. Perfection Corp.
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Or Approved Equal

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or Approved Equal
  - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece/Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.
- D. One-Piece/Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi, 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.



- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type or One-piece, stamped steel type.
    - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than **4 inches** larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use **4000-psi**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.9 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout around anchors.
- G. Cure placed grout.

END OF SECTION 220501

## SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.

- B. Related Sections:

1. Section 221116 "Domestic Water Piping" for water meters inside the building.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers:

1. Palmer Wahl Instruments Inc.

2. H.O. Trerice Co.
  3. Weiss Instruments, Inc.
  4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  5. Or Approved Equal.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg. F.
- E. Connector Type(s): Union joint, adjustable angle or rigid, with unified-inch screw threads.
- F. Connector Size: 1/2 inch with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

## 2.2 LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
1. Palmer Wahl Instruments Inc.
  2. H.O. Trerice Co.
  3. Weiss Instruments, Inc.
  4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  5. Or Approved Equal.
- B. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
  2. Case: Cast aluminum, 6-inch nominal size.
  3. Case Form: Back angle or Straight unless otherwise indicated.
  4. Tube: Glass with magnifying lens and blue [or red] organic liquid.
  5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F.
  6. Window: Glass or plastic.
  7. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  8. Connector: 3/4 inch, with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum, 9-inch (229-mm) nominal size unless otherwise indicated.
3. Case Form: Adjustable angle, Back angle or Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: [CNR] [or] [CUNI] <Insert material>.
4. Material for Use with Steel Piping: [CRES] [CSA] <Insert material>.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES

A. Manufacturers:

1. Palmer Wahl Instruments Inc.
2. H.O. Trerice Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
5. Or Approved Equal.

- B. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
  2. Case: [Liquid-filled] [Sealed] [Open-front, pressure relief] [Solid-front, pressure relief] type(s); cast aluminum; 4-1/2-inch nominal diameter.
  3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  4. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  5. Movement: Mechanical, with link to pressure element and connection to pointer.
  6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  7. Pointer: Dark-colored metal.
  8. Window: Glass.
  9. Ring: Stainless steel.
  10. Accuracy: Grade A, plus or minus 1 percent of middle half of.
- C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
  2. Case: Liquid-filled, Sealed type; cast aluminum; 4-1/2-inch nominal diameter with [back] [front] flange and holes for panel mounting.
  3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  4. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  5. Movement: Mechanical, with link to pressure element and connection to pointer.
  6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  7. Pointer: Dark-colored metal.
  8. Window: Glass.
  9. Ring: Stainless steel.
  10. Accuracy: Grade A, plus or minus 1 percent of middle half of.

## 2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and [piston] [porous-metal]-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads.

## 2.6 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: [NPS 1/4 (DN 8)] [or] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.



- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending [a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
- L. Install pressure gages in the following locations:
  - 1. Suction and discharge of each domestic water pump.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled or Sealed, bimetallic-actuated type.
  - 2. Industrial]-style, liquid-in-glass type.
  - 3. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.
- C. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
  - 1. Liquid-filled, Sealed, direct-mounted, metal case.
  - 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- D. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
  - 1. Liquid-filled, Sealed, direct-mounted, metal case.
  - 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

### 3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 200 psi.
- B. Scale Range for Domestic Water Piping: 0 to 200 psi.

END OF SECTION 220519

## SECTION 220523 – PLUMBING VALVES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following general-duty valves (Lead Free Type):
  - 1. Copper-alloy ball valves.
  - 2. Ferrous-alloy ball valves.
  - 3. Bronze check valves.
  - 4. Ferrous-alloy wafer check valves.
  - 5. Spring-loaded, lift-disc check valves.
  - 6. Bronze globe valves.
- B. Related Sections include the following:
  - 1. Division 22 Section for valve tags and charts.
  - 2. Division 22 piping Sections for specialty valves applicable to those Sections only.
- C. All valves and fittings for potable water system shall be lead-free type in compliance with requirements of NSF/ANSI Standard 61.

#### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PTFE: Polytetrafluoroethylene plastic.
  - 5. SWP: Steam working pressure.
  - 6. TFE: Tetrafluoroethylene plastic.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

## 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand-wheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.

- B. Bronze/Brass Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  - 1. Chain wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
  - 2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
  - 3. Hand wheel: For valves other than quarter-turn types.
  - 4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
  - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Bypass and Drain Connections: MSS SP-45.

## 2.3 COPPER-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. One-Piece, Copper-Alloy Ball Valves:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Grinnell Corporation.
    - d. Kitz Corporation of America.
    - e. Legend Valve & Fitting, Inc.
    - f. NIBCO INC.
    - g. Watts Industries, Inc.; Water Products Div.
    - h. Or Approved Equal.
- C. Copper-Alloy Ball Valves, General: MSS SP-110, full port type.
- D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, full port type.

## 2.4 FERROUS-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. American Valve, Inc.
  - 2. Conbraco Industries, Inc.; Apollo Div.
  - 3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
  - 4. Flow-Tek, Inc.
  - 5. Hammond Valve.
  - 6. Kitz Corporation of America.
  - 7. KTM Products, Inc.
  - 8. Milwaukee Valve Company.
  - 9. NIBCO INC.
  - 10. Richards Industries; Marwin Ball Valves.
  - 11. Or Approved Equal.
- C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends, full port.
- D. Ferrous-Alloy Ball Valves: Class 150, full port.

## 2.5 BRONZE CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Red-White Valve Corp.
    - c. Walworth Co.
    - d. Or Approved Equal.
  - 2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Red-White Valve Corp.
    - c. NIBCO INC.
    - d. Or Approved Equal.
  - 3. Type 3, Bronze, Swing Check Valves with Metal Disc:
    - a. American Valve, Inc.
    - b. Cincinnati Valve Co.
    - c. Grinnell Corporation.
    - d. Hammond Valve.
    - e. Kitz Corporation of America.
    - f. Legend Valve & Fitting, Inc.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.

- i. Powell, Wm. Co.
- j. Red-White Valve Corp.
- k. Walworth Co.
- l. Watts Industries, Inc.; Water Products Div.
- m. Or Approved Equal.

- C. Bronze Check Valves, General: MSS SP-80.
- D. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
- E. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.
- F. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

## 2.6 FERROUS-ALLOY WAFER CHECK VALVES

- A. Available Manufacturers:

- B. Manufacturers:

- 1. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

- a. Gulf Valve Co.
- b. Valve and Primer Corp.
- c. NIBCO INC.
- d. Or Approved Equal.

- 2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

- a. Gulf Valve Co.
- b. Techno Corp.
- c. NIBCO INC.
- d. Or Approved Equal.

- C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
- D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

## 2.7 SPRING-LOADED, LIFT-DISC CHECK VALVES

- A. Available Manufacturers:

- B. Manufacturers:

- 1. Type I, Wafer Lift-Disc Check Valves:

- a. Mueller Steam Specialty. NIBCO INC.
- b. Or Approved Equal.

2. Type II, Compact-Wafer, Lift-Disc Check Valves:
    - a. Durabla Fluid Technology, Inc.
    - b. Flomatic Valves.
    - c. Grinnell Corporation.
    - d. Metraflex Co.
    - e. Milwaukee Valve Company.
    - f. Mueller Steam Specialty.
    - g. NIBCO INC.
    - h. Or Approved Equal.
  3. Type III, Globe Lift-Disc Check Valves:
    - a. Durabla Fluid Technology, Inc.
    - b. GA Industries, Inc.
    - c. Grinnell Corporation.
    - d. Metraflex Co.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Or Approved Equal.
  4. Type IV, Threaded Lift-Disc Check Valves:
    - a. Check-All Valve Mfg. Co.
    - b. Durabla Fluid Technology, Inc.
    - c. Grinnell Corporation.
    - d. Legend Valve & Fitting, Inc.
    - e. Metraflex Co.
    - f. Milwaukee Valve Company.
    - g. Mueller Steam Specialty.
    - h. NIBCO INC.
    - i. Watts Industries, Inc.; Water Products Div.
    - j. Or Approved Equal.
- C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
  - D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
  - E. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
  - F. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
  - G. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.



## 2.8 BRONZE GLOBE VALVES

### A. Available Manufacturers:

### B. Manufacturers:

#### 1. Type 1, Bronze Globe Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Hammond Valve.
- d. Kitz Corporation of America.
- e. Legend Valve & Fitting, Inc.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell, Wm. Co.
- i. Red-White Valve Corp.
- j. Walworth Co.
- k. Or Approved Equal.

#### 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Hammond Valve.
- d. Kitz Corporation of America.
- e. McWane, Inc.; Kennedy Valve Div.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell, Wm. Co.
- i. Red-White Valve Corp.
- j. Walworth Co.
- k. Or Approved Equal.

#### 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Walworth Co.
- g. Or Approved Equal.

### C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.

### D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

### E. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball valves.
  - 2. Throttling Service: Ball or globe valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Heating Water Piping: Use the following types of valves:
  - 1. Ball Valves, NPS 2 (DN 50) and Smaller: One or Two-piece, CWP rating, copper alloy.
  - 2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
  - 3. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal / vertical, bronze.
  - 4. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
  - 5. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
  - 6. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Single / Dual-plate, wafer-lug/ double-flanged, Class 150, ferrous alloy.
  - 7. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
  - 8. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
  - 9. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523



## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Fiberglass strut systems.
  - 6. Thermal-hanger shield inserts.
  - 7. Fastener systems.
  - 8. Pipe stands.
  - 9. Equipment supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Fiberglass pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Powder-actuated fastener systems.
  - 5. Pipe positioning systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Fiberglass strut systems. Include Product Data for components.
  - 4. Pipe stands. Include Product Data for components.
  - 5. Equipment supports.
  - 6. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 5. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  - 1. Manufacturers' catalogs indicate that copper pipe hangers are small, typically NPS 4 (DN 100) or smaller, and types available are limited.
  - 2. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Stainless steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

5. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Non-staining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
- C. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- D. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- E. Metal framing system in first paragraph below requires calculating and detailing at each use.
- F. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- G. Fiberglass strut system in first paragraph below requires calculating and detailing at each use.
- H. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping
- I. Fastener System Installation:
  1. Verify suitability of fasteners in two subparagraphs below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
  2. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use



- operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
3. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- J. Pipe stand in first paragraph below requires calculating and detailing at each use.
- K. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
  3. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- L. Equipment support in first paragraph below requires calculating and detailing at each use.
- M. Equipment Support Installation:
1. Fabricate from welded-structural-steel shapes.
  2. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
  3. Install lateral bracing with pipe hangers and supports to prevent swaying.
  4. Install building attachments within concrete slabs or attach to structural steel.
  5. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2 (DN 65)] <Insert size> and larger and at changes in direction of piping.
  6. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
1. Attach clamps and spacers to piping.
  2. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  3. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  4. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  5. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated.
  6. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  7. High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.
  8. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

Q. Shield Dimensions for Pipe: Not less than the following:

1. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
2. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
3. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
4. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
5. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

R. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

S. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- C. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting".
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 220529

## SECTION 220548 - VIBRATION AND SEISMIC CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Restrained spring isolators.
  - 2. Housed spring mounts.
  - 3. Spring hangers.
  - 4. Spring hangers with vertical-limit stops.
  - 5. Thrust limits.
  - 6. Pipe riser resilient supports.
  - 7. Restraining cables.
- B. Definitions:
  - 1.  $A_v$ : Effective peak velocity related acceleration coefficient.

#### 1.2 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 5. Details for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

#### 1.3 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-

restraint designs must be signed and sealed by a registered professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 VIBRATION ISOLATORS

- A. Available Manufacturers:
  - 1. Ace Mounting Co., Inc.
  - 2. Amber/Booth Company, Inc.
  - 3. B-Line Systems, Inc.
  - 4. California Dynamics Corp.
  - 5. Isolation Technology, Inc.
  - 6. Kinetics Noise Control, Inc.
  - 7. Mason Industries, Inc.
  - 8. Vibration Eliminator Co., Inc.
  - 9. Vibration Isolation Co., Inc.
  - 10. Vibration Mountings & Controls/Korfund.
  - 11. Or Approved Equal.
- B. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
  - 1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  - 2. Neoprene: Shock-absorbing materials compounded as defined by AASHTO.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
  - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.



4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- E. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
  2. Base: Factory drilled for bolting to structure.
  3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
- F. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 deg rees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
- J. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.3 SEISMIC-RESTRAINT DEVICES

### A. Available Manufacturers:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. California Dynamics Corp.
4. Kinetics Noise Control, Inc.
5. Loos & Co., Inc.; Cableware Technology Division.
6. Mason Industries, Inc.
7. TOLCO Incorporated.
8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
9. Vibration Eliminator Co., Inc.
10. Vibration Isolation Co., Inc.
11. Vibration Mountings & Controls/Korfund.

12. Or Approved Equal.

- B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5, with a flat washer face.
- C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  - 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5.
- D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
- E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- B. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- C. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- D. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- E. Install resilient bolt isolation washers on equipment anchor bolts.

#### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Inspect isolator seismic-restraint clearance.
  - 2. Test isolator deflection.
  - 3. Inspect minimum snubber clearances.
- B. Provide certification report to A/E.

### 3.3 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust air spring leveling mechanism.
- E. Adjust active height of spring isolators.
- F. Adjust snubbers according to manufacturer's written recommendations.
- G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

END OF SECTION 220548

## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates
2. Equipment markers
3. Equipment signs
4. Access panel and door markers
5. Valve tags
6. Pipe Markers

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
  - a. Manufacturer, product name, model number, and serial number.
  - b. Capacity, operating and power characteristics, and essential data.
  - c. Labels of tested compliances.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

- a. Name and plan number
  - b. Equipment service
  - c. Design capacity
  - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed
- 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Thickness: 1/8 inch, unless otherwise indicated.
  - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 3. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

### 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.
  1. Material: 0.032 inch-thick brass/aluminum
  2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
  1. Fuel-burning units, including boilers, furnaces, heaters
  2. Pumps and similar motor-driven units.
  3. Fans.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
  1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible.
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Meters, gages, thermometers, and similar units.
    - c. Fuel-burning units, including boilers, furnaces, heaters.
    - d. Pumps and similar motor-driven units.

e. Fans.

- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- D. Install access panel markers with screws on equipment access panels.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
  2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
  3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
  4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.



- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

- 1. Valve-Tag Size and Shape:

- a. Domestic Water: 1-1/2 inches, round/square
    - b. Gas: 1-1/2 inches, round/square

### 3.5 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices.

END OF SECTION 220553



## SECTION 220719 – PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
  - 1. Insulation Materials:
    - a. Cellular glass.
    - b. Mineral fiber.
    - c. Polystyrene.
  - 2. Fire-rated insulation systems.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Field-applied jackets.
  - 8. Tapes.
  - 9. Securements.
  - 10. Corner angles.

#### 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Removable insulation at piping specialties, equipment connections, and access panels.
  6. Application of field-applied jackets.
  7. Application at linkages of control devices.
  8. Field application for each equipment type.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 (DN 50).
  2. Sheet Form Insulation Materials: 12 inches square.
  3. Jacket Materials for Pipe: 12 inches long by NPS 2 (DN 50).
  4. Sheet Jacket Materials: 12 inches square.
  5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- D. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- F. Field quality-control inspection reports.

## 1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. Cell-U-Foam Corporation; Ultra-CUF.
    - b. Pittsburgh Corning Corporation; Foamglas Super K.
    - c. Or Approved Equal.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.

4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:
  - a. Fibrex Insulations Inc.; Coreplus 1200.
  - b. Johns Manville; Micro-Lok.
  - c. Knauf Insulation; 1000° Pipe Insulation.
  - d. Manson Insulation Inc.; Alley-K.
  - e. Owens Corning; Fiberglas Pipe Insulation.
  - f. Or Approved Equal.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products:
  - a. Knauf Insulation; Permawick Pipe Insulation.
  - b. Owens Corning; VaporWick Pipe Insulation.
  - c. Or Approved Equal.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied [ASJ] [FSK jacket] complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:
  - a. CertainTeed Corp.; CrimpWrap.
  - b. Johns Manville; MicroFlex.
  - c. Knauf Insulation; Pipe and Tank Insulation.
  - d. Manson Insulation Inc.; AK Flex.
  - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
  - f. Or Approved Equal.

## 2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. UL tested and certified to provide a 2-hour fire rating.

1. Products:

- a. Johns Manville; Super Firetemp M.
  - b. Or Approved Equal.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.
  - 1. Products:
    - a. CertainTeed Corp.; FlameChek.
    - b. Johns Manville; Firetemp Wrap.
    - c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
    - d. Thermal Ceramics; FireMaster Duct Wrap.
    - e. 3M; Fire Barrier Wrap Products.
    - f. Unifrax Corporation; FyreWrap.
    - g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.
    - h. Or Approved Equal.

## 2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-97.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    - c. Marathon Industries, Inc.; 290.
    - d. Mon-Eco Industries, Inc.; 22-30.
    - e. Vimasco Corporation; 760.
    - f. Or Approved Equal.
- C. Cellular-Glass, Phenolic-Foam, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
    - c. Or Approved Equal.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
    - e. Or Approved Equal.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.

- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
  - d. Marathon Industries, Inc.; 225.
  - e. Mon-Eco Industries, Inc.; 22-25.
  - f. Or Approved Equal.
- F. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 97-13.
    - c. Or Approved Equal.
- G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
    - f. Or Approved Equal.
- H. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products:
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Red Devil, Inc.; Celulon Ultra Clear.
    - e. Speedline Corporation; Speedline Vinyl Adhesive.
    - f. Or Approved Equal.

## 2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
    - g. Or Approved Equal.
  - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.



4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:
  - a. Childers Products, Division of ITW; CP-30.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
  - c. ITW TACC, Division of Illinois Tool Works; CB-25.
  - d. Marathon Industries, Inc.; 501.
  - e. Mon-Eco Industries, Inc.; 55-10.
  - f. Or Approved Equal.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:
  - a. Childers Products, Division of ITW; Encacel.
  - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
  - c. Marathon Industries, Inc.; 570.
  - d. Mon-Eco Industries, Inc.; 55-70.
  - e. Or Approved Equal.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:
  - a. Childers Products, Division of ITW; CP-10.
  - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
  - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
  - d. Marathon Industries, Inc.; 550.
  - e. Mon-Eco Industries, Inc.; 55-50.
  - f. Vimasco Corporation; WC-1/WC-5.
  - g. Or Approved Equal.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

## 2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

- a. Childers Products, Division of ITW; CP-52.
  - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
  - c. Marathon Industries, Inc.; 130.
  - d. Mon-Eco Industries, Inc.; 11-30.
  - e. Vimasco Corporation; 136.
  - f. Or Approved Equal.
- 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
  - 3. Service Temperature Range: Minus 50 to plus 180 deg F.
  - 4. Color: White.

## 2.7 SEALANTS

### A. Joint Sealants:

- 1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:
  - a. Childers Products, Division of ITW; CP-76.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
  - f. Vimasco Corporation; 750.
  - g. Or Approved Equal.
- 2. Joint Sealants for Polystyrene Products:
  - a. Childers Products, Division of ITW; CP-70.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
  - f. Or Approved Equal.
- 3. Materials shall be compatible with insulation materials, jackets, and substrates.
- 4. Permanently flexible, elastomeric sealant.
- 5. Service Temperature Range: Minus 100 to plus 300 deg F.
- 6. Color: White or gray.

### B. FSK and Metal Jacket Flashing Sealants:

- 1. Products:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
  - f. Or Approved Equal.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F.
- 5. Color: Aluminum.

### C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:
  - a. Childers Products, Division of ITW; CP-76.
  - b. Or Approved Equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Products:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
    - e. Or Approved Equal.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.
- D. Metal Jacket:
  1. Products:
    - a. Childers Products, Division of ITW; Metal Jacketing Systems.
    - b. PABCO Metals Corporation; Surefit.
    - c. RPR Products, Inc.; Insul-Mate.
    - d. Or Approved Equal.
- E. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
  1. Products:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
    - e. Or Approved Equal.
  2. Width: 3 inches
  3. Thickness: 11.5 mils
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
    - e. Or Approved Equal.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
    - e. Or Approved Equal.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.
    - e. Or Approved Equal.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

### A. Bands:

1. Products:
  - a. Childers Products; Bands.
  - b. PABCO Metals Corporation; Bands.
  - c. RPR Products, Inc.; Bands.
  - d. Or Approved Equal.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated.
  - a. Products:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
    - 5) Or Approved Equal.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
    - 5) Or Approved equal
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products:
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.

- 2) GEMCO; Perforated Base.
  - 3) Midwest Fasteners, Inc.; Spindle.
  - 4) Or Approved Equal
- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
    - 5) Or Approved Equal.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
  - 1. Manufacturers:
    - a. ACS Industries, Inc.
    - b. C & F Wire.
    - c. Childers Products.
    - d. PABCO Metals Corporation.
    - e. RPR Products, Inc.
    - f. Or Approved Equal.

## 2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches or 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.



2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."
- F. Insulation Installation at Floor Penetrations:
  1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  2. Pipe: Install insulation continuously through floor penetrations.

3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

### 3.5 DUCT AND PLENUM INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

### 3.6 EQUIPMENT INSULATION INSTALLATION

- A. Secure insulation with adhesive and anchor pins and speed washers.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.
  4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    - f. Impale insulation over anchor pins and attach speed washers.
    - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make

taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

### 3.7 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.8 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.10 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.11 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

### 3.12 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.13 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Below-grade piping.
  - 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.14 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. **NPS 3 (DN 75)** and Smaller: Insulation shall be any of the following:
    - a. Cellular Glass: **1-1/2 inch** thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: **1-1/2 inch** thick.
  - 2. **NPS 4 (DN 32)** and Larger: Insulation shall be any of the following:
    - a. Cellular Glass: **2 inches** thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: **2 inches** thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. **NPS 3 (DN 75)** and Smaller: Insulation shall be[ any of] the following:
    - a. Cellular Glass: **1-1/2 inches** thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: **1-1/2 inch** thick.
  - 2. **NPS 4 (DN 100)** and Larger: Insulation shall be any of the following:
    - a. Cellular Glass: **2 inches** thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: **2 inch** thick.
- C. Roof Leader and Storm:
  - 1. **NPS 4 (DN 32)** and Smaller: Insulation shall be any of the following:
    - a. Cellular Glass: **1 inch** thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: **1 inch** thick.
- D. Condensate Drain:
  - 1. **Refer to Dwg. P0.01 for insulation requirements.**

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 220719



## SECTION 221116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes domestic water piping inside the building and 5 feet to outside of the building.
- B. Related Sections include the following:
  - 1. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.3 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

### 2.4 VALVES

- A. General-duty ball valves are specified in Division 22 Section "Plumbing Valves."

- B. Backflow preventers, strainers, and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

## PART 3 - EXECUTION

### 3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 (DN 100) and Smaller: Soft copper tube, Type K with no fittings.
- E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  - 1. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. NPS 2 (DN 50) and larger: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

### 3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves for piping NPS 3 (DN 75) and smaller.
  - 2. Drain Duty: Hose-end drain valves.
- B. Install drain valves at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."

- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."
- B. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 (DN 20) and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
  - 6. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
- G. Install supports for vertical copper tubing every 10 feet.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.8 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  - 4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 5. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

## SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
  - 1. Reduced-Pressure-Principle Backflow Preventers.
  - 2. Balancing valves.
  - 3. Strainers.
  - 4. Hose Bibbs.
  - 5. Wall hydrants.
  - 6. Drain valves.
  - 7. Water hammer arresters.
  - 8. Trap-seal primer valves.
- B. All plumbing fixtures, backflow preventers, valves, strainers and fittings for potable water system shall be lead-free type in compliant with requirements of NSF/ANSI Standard 61.
- C. PERFORMANCE REQUIREMENTS
- D. Minimum Working Pressure for Domestic Water Piping Specialties: 80 psig, unless otherwise indicated.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 REDUCED-PRESSURE-PRINCIPLE BACKFLOW PREVENTERS (Lead Free Type)

A. Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - b. Ames Fire & Waterworks.
  - c. Conbraco Industries, Inc.
  - d. Zurn Industries.
  - e. Or Approved Equal.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Size: Refer to drawings.
5. Accessories:
  - a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.2 BALANCING VALVES (Lead Free Type)

A. Memory-Stop Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Conbraco Industries, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
  - e. Red-White Valve Corp.
  - f. Or Approved Equal.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.



7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

## 2.3 STRAINERS FOR DOMESTIC WATER PIPING (Lead Free Type)

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron[ with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and] for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch.
6. Drain: Pipe plug or Factory-installed, hose-end drain valve.

## 2.4 DRAIN VALVES (Lead Free Type)

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).

4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

## 2.5 HOSE BIBBS

### A. Hose Bibbs: Refer to plumbing schedule.

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.6 WALL HYDRANTS

### A. Non-Freeze Wall Hydrants: Refer to plumbing schedule.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
  - j. Or Approved Equal.
3. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig.
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).

8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Chrome plated.
11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
12. Nozzle and Wall-Plate Finish: Rough bronze.
13. Operating Keys(s): Two (2) with each wall hydrant.

## 2.7 WATER HAMMER ARRESTERS

### A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMTROL, Inc.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. PPP Inc.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - g. Tyler Pipe; Wade Div.
  - h. Watts Drainage Products Inc.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
  - j. Or Approved Equal.
3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: [Metal bellows] [Copper tube with piston].
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.8 TRAP-SEAL PRIMER VALVES

### A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. PPP Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Watts Industries, Inc.; Water Products Div.
  - f. Or Approved Equal.

3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet. Refer to plumbing schedule for locations, make & model.
- E. Install water hammer arresters in water piping according to PDI-WH 201.
- F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- H. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Outlet boxes.
  - 2. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification For Plumbing Piping And Equipment."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each system according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119



## SECTION 221123 – FACILITY NATURAL-GAS PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes fuel gas piping within the building. Products include the following:
  - 1. Pipe, tube, fittings, and joining materials.
  - 2. Protective pipe and fitting coating.
  - 3. Piping specialties.
  - 4. Specialty valves.
  - 5. Pressure regulators.

#### 1.3 PROJECT CONDITIONS

- A. Gas System Pressures: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2.0 psig, and is reduced to secondary pressure of 0.5 psig or less.
- B. Design values of fuel gas supplied for these systems are as follows:
  - 1. Nominal Heating Value: 1000 Btu/cu. ft.
  - 2. Nominal Specific Gravity: 0.6.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Piping.
  - 2. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 3. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
- B. Shop Drawings: For fuel gas piping. Include plans and attachments to other work.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Welding certificates.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Standard: Comply with NFPA 54, "International Fuel Gas Code."
- D. Installation shall follow "International Fuel Gas Code" Section 404.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

## 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.



1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
4. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
5. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

#### 2.4 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

#### 2.5 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.
- B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

#### 2.6 SPECIALTY VALVES

- A. Valves, NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
- B. Valves, NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
- C. Appliance Connector Valves: ANSI Z21.15 and CSA International listed.
  1. Manufacturers:
    - a. American Valve Inc.
    - b. B&K Industries, Inc.
    - c. Brass Craft Manufacturing Co.
    - d. Conbraco Industries, Inc.; Apollo Div.
    - e. JMF Company.
    - f. Jomar International Ltd.
    - g. Key Gas Components, Inc.
    - h. Legend Valve and Fitting, Inc.
    - i. McDonald, A. Y. Mfg. Co.
    - j. Mueller Co.; Mueller Gas Products Div.
    - k. Newman Hattersley Ltd.; Specialty Valves Div.
    - l. Robert Manufacturing Co.

- m. State Metals, Inc.
  - n. Watts Industries, Inc.; Water Products Div.
  - o. Or Approved Equal.
- D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.
- E. Gas Valves, NPS 2 (DN 50) and Smaller: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.
  - 1. Manufacturers:
    - a. Dungs, Karl, Inc.
    - b. Flow Control Equipment, Inc.
    - c. Grinnell Corp.
    - d. Honeywell International Inc.
    - e. Jomar International Ltd.
    - f. KITZ Corporation.
    - g. Legend Valve and Fitting, Inc.
    - h. McDonald, A. Y. Mfg. Co.
    - i. Milwaukee Valve Company.
    - j. Mueller Co.; Mueller Gas Products Div.
    - k. NIBCO INC.
    - l. Red-White Valve Corp.
    - m. Watts Industries, Inc.; Water Products Div.
    - n. Or Approved Equal.
  - 2. Tamperproof Feature: Include design for locking.
- F. Plug Valves, NPS 2-1/2 (DN 65) and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.
  - 1. Manufacturers:
    - a. Flow Control Equipment, Inc.
    - b. Milliken Valve Co., Inc.
    - c. Nordstrom Valves, Inc.
    - d. Olson Technologies, Inc.; Homestead Valve Div.
    - e. Walworth Co.
    - f. Or Approved Equal.
  - 2. Tamperproof Feature: Include design for locking.
- G. General-Duty Valves, NPS 2-1/2 (DN 65) and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.
  - 1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.
  - 2. Butterfly Valves: MSS SP-67, lug type with lever handle.
- H. Automatic Gas Valves: ANSI Z21.21, with electrical/mechanical operator for actuation by appliance automatic shutoff device.
  - 1. Manufacturers:

- a. ASCO General Controls.
  - b. ASCO Power Technologies, LP; Division of Emerson.
  - c. ASCO Valve Canada, Division of Emerson Electric Canada Limited.
  - d. Dungs, Karl, Inc.
  - e. Eaton Corporation; Controls Div.
  - f. Eclipse Combustion, Inc.
  - g. GPS Gas Protection Systems Inc.
  - h. Honeywell International Inc.
  - i. Johnson Controls.
  - j. Or Approved Equal.
- I. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.
  - 1. Manufacturers:
    - a. ASCO General Controls.
    - b. ASCO Power Technologies, LP; Division of Emerson.
    - c. Dungs, Karl, Inc.
    - d. Eclipse Combustion, Inc.
    - e. Goyen Valve Corp.; Tyco Environmental Systems.
    - f. Magnatrol Valve Corp.
    - g. Watts Industries, Inc.
    - h. Or Approved Equal.

## 2.7 PRESSURE REGULATORS

- A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
  - 1. Manufacturers:
    - a. Line Pressure Regulators:
      - 1) Invensys.
      - 2) Maxitrol Company.
      - 3) National Meter Industries, Inc.
      - 4) Schlumberger Limited; Gas Div.
      - 5) Or Approved Equal.
    - b. Appliance Pressure Regulators:
      - 1) Eaton Corporation; Controls Div.
      - 2) Harper Wyman Co.
      - 3) Maxitrol Company.
      - 4) SCP, Inc.
      - 5) Or Approved Equal.
  - 2. NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
  - 3. NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

4. Service Pressure Regulators: ANSI Z21.80. Include 100-psig minimum inlet pressure rating.
  5. Line Pressure Regulators: ANSI Z21.80 with 2-psig minimum inlet pressure rating.
  6. Line Pressure Regulators: ANSI Z21.80 with 10-psig inlet pressure rating, unless otherwise indicated.
  7. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for fuel piping system to verify actual locations of piping connections before equipment installation.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

### 3.3 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
- B. Fuel Gas Piping, 2 psig or Less - aboveground or in pipe tunnel:
1. NPS 3/4 and NPS 1 (DN 20 and DN 25) Steel pipe, malleable-iron threaded fittings, and threaded joints.
  2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50) Steel pipe, steel welding fittings, and welded joints.
  3. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel welding fittings, and welded joints.
- C. Fuel Gas Piping, 2 psig or Less below slab:
1. NPS 3/4 and NPS 2 (DN 20 and DN 50) TracPipe Counterstrike CSST stainless steel gas pipe with fittings, or approved equal manufacturers.

### 3.4 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.
- B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.
- C. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.
- D. Piping Line Valves, NPS 2-1/2 (DN 65) and Larger: Plug valve or general-duty valve.

### 3.5 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section.
- B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
  - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
  - 2. In Floors: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in floors, subject to approval of authorities having jurisdiction. Surround piping cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
  - 3. In Floor Channels: Gas piping may be installed in floor channels, subject to approval of authorities having jurisdiction. Channels must have cover and be open to space above cover for ventilation.
  - 4. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
    - a. Exception: Tubing passing through partitions or walls.
  - 5. In Walls: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in masonry walls, subject to approval of authorities having jurisdiction.
  - 6. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - a. Exception: Accessible above-ceiling space specified above.
- C. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3

inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

- D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.
- E. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- G. Connect branch piping from top or side of horizontal piping.
- H. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- I. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
- J. Install flanges on valves, specialties, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- K. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- L. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

### 3.6 JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 23 Section.
- B. Use materials suitable for fuel gas.
  - 1. Brazed Joints: Make with brazing alloy with melting point greater than 1000 deg F. Brazing alloys containing phosphorus are prohibited.
- C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 23 Section "Hangers and Supports for HVACR Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4 (DN 32): Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

### 3.8 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
  1. Do not use gas pipe as grounding electrode.
- F. Connect wiring according to Division 26 Section "Building Wire and Cable."

### 3.9 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each pressure regulator, and specialty valve.
  1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
  2. Nameplates, pipe identification, and signs are specified in Division 23 Section "Mechanical Identification."

### 3.10 PAINTING

- A. Use materials and procedures in Division 09 Sections.
- B. Paint gas piping.
  1. Color: Yellow (1 primer, 2 finish coats).

### 3.11 FIELD QUALITY CONTROL

- A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.

- B. Pressure-test gas piping at 15 psi test pressure for a minimum of two (2) hours. Exam all piping joints and connections for leakage. Eliminate leakage and repeat the pressure testing until no leakage is found.
- C. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- D. Verify capacities and pressure ratings of pressure regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

END OF SECTION 221123



## SECTION 221316 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
  - 3. Encasement for underground metal piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and International Building Code – New Jersey Edition – Latest Edition

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
  - 2. Sovent Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, hemp fiber.

### 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO.
      - 2) Fernco, Inc.
      - 3) Ideal Div.; Stant Corp.
      - 4) Mission Rubber Co.
      - 5) Tyler Pipe; Soil Pipe Div.
      - 6) Charlotte Pipe & Foundry Co.
      - 7) Or Approved Equal.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
  - a. Manufacturers:
    - 1) ANACO.
    - 2) Clamp-All Corp.
    - 3) Ideal Div.; Stant Corp.
    - 4) Mission Rubber Co.
    - 5) Tyler Pipe; Soil Pipe Div.
    - 6) Charlotte Pipe & Foundry Co.
    - 7) Or Approved Equal.
3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
  - a. Manufacturers:
    - 1) MG Piping Products Co.
    - 2) Or Approved Equal.

## 2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
  1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
  1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron.

## 2.6 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

## 2.7 SPECIAL PIPE FITTINGS

- A. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.
    - c. Or Approved Equal
- B. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser, Inc.; DMD Div.
    - c. EBAA Iron Sales, Inc.
    - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    - e. JCM Industries, Inc.
    - f. Romac Industries, Inc.
    - g. Smith-Blair, Inc.
    - h. Viking Johnson.
    - i. Or Approved Equal.
  2. Center-Sleeve Material: Manufacturer's standard.
  3. Gasket Material: Natural or synthetic rubber.
  4. Metal Component Finish: Corrosion-resistant coating or material.
- C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
1. Manufacturers:
    - a. EBAA Iron Sales, Inc.
    - b. Or Approved Equal.

- D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

- a. EBAA Iron Sales, Inc.
- b. Romac Industries, Inc.
- c. Star Pipe Products; Star Fittings Div.
- d. Or Approved Equal.

- E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

- a. SIGMA Corp.
- b. Or Approved Equal.

## 2.8 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping shall be any of the following:
  1. Hubless cast-iron soil pipe and fittings and couplings; and hubless-coupling joints.
  2. Steel pipe, drainage fittings, and threaded joints.
  3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
  4. Copper DWV tube, copper drainage fittings, and soldered joints.
  5. Dissimilar Pipe-Material Couplings: Shielded Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
  2. Steel pipe, drainage fittings, and threaded joints.
  3. Dissimilar Pipe-Material Couplings: Shielded Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Hubless cast-iron soil pipe and fittings; couplings; and hubless-coupling joints.
  2. Steel pipe, drainage fittings, and threaded joints.
  3. Stainless-steel pipe and fittings gaskets, and gasketed joints.
  4. Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.
  5. Dissimilar Pipe-Material Couplings: Shielded nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:
1. Hubless cast-iron soil pipe and fittings; shielded, stainless-steel couplings; and hubless-coupling joints.
  2. Steel pipe, drainage fittings, and threaded joints.
  3. Dissimilar Pipe-Material Couplings: Shielded Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Service class, cast-iron bell and spigot type soil pipe with gasketed joints.
  2. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
  3. Dissimilar Pipe-Material Couplings: Shielded Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
1. Service class, cast-iron bell and spigot type soil pipe with gasketed joints.
  2. Dissimilar Pipe-Material Couplings: Shielded nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls."

- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  - 2. Solvent Drainage System: Comply with ASSE 1043 and vent fitting manufacturer's written installation instructions.
  - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "Valves."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.



2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch rod.
  4. NPS 6 (DN 150): 60 inches with 3/4-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 84 inches with 3/8-inch rod.
  2. NPS 1-1/2 (DN 40): 108 inches with 3/8-inch rod.
  3. NPS 2 (DN 50): 10 feet with 3/8-inch rod.
  4. NPS 2-1/2 (DN 65): 11 feet with 1/2-inch rod.
  5. NPS 3 (DN 80): 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet with 5/8-inch rod.
  7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50): 84 inches with 3/8-inch rod.
  2. NPS 3 (DN 80): 96 inches with 1/2-inch rod.
  3. NPS 4 (DN 100): 108 inches with 1/2-inch rod.
  4. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
- K. Install supports for vertical stainless-steel piping every 10 feet.
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
  3. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
  4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
  5. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
- M. Install supports for vertical copper tubing every 10 feet.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

### 3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316



## SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous drainage piping specialties.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
- B. Manufacturer Seismic Qualification Certification: Submit certification that all accessories, and components will withstand seismic forces defined in Division 22 Section "Plumbing Vibration and Seismic Controls." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate size and location of roof penetrations.

## 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

- A. Metal Floor Cleanouts:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
    - a. MIFAB, Inc.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Or Approved Equal.
- B. Stainless Steel Wall Cleanouts:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

- a. MIFAB, Inc.
- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Tyler Pipe; Wade Div.
- d. Watts Drainage Products Inc.
- e. Or Approved Equal.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
  - a. MIFAB, Inc.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Or Approved Equal.
- 4. Standard: ASME A112.6.3 with backwater valve.
- 5. Pattern: Floor drain.
- 6. Outlet: Side.
- 7. Sediment Bucket: Refer to plumbing schedule.
- 8. Top or Strainer Material: Bronze.
- 9. Top of Body and Strainer Finish: Nickel bronze.
- 10. Top Shape: Round.

## 2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

### A. Open Drains:

- 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
- 2. Size: Same as connected waste piping [with increaser fitting of size indicated].

### B. Deep-Seal Traps:

- 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
- 2. Size: Same as connected waste piping.
  - a. NPS 2 (DN 50): 4-inch minimum water seal.
  - b. NPS 2-1/2 (DN 65) and Larger: 5-inch minimum water seal.

### C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch (25 mm)] [2 inches (51 mm)] <Insert dimension> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

J. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.



2. Size: Inlet size to match downspout.
3. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
4. Size: Same as or larger than connected downspout.

K. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

## 2.4 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
  2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
  3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Applications: 12 oz./sq. ft.
  2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

## SECTION 221323 - SANITARY WASTE INTERCEPTORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Grease interceptor.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of metal interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
  - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:
  - 1. Interceptors.
  - 2. Piping connections. Include size, location, and elevation of each.
  - 3. Interface with underground structures and utility services.

#### 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
  - 1. Notify Architect/Engineer and Owner no fewer than seven days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of sewer services without Architect/Engineer's and Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 GREASE INTERCEPTOR

#### A. Manufacturers:

1. Jay. R. Smith Mfg. Co.
2. Watts Industries, Inc.
3. MIFAB
4. Or Approved Equal.

#### B. Grease Interceptor:

1. Steel interceptor with Gray Duco coating inside and outside with flow control fitting.
2. Include rubber-gasketed joints, vent connections, removal baffles, and piping or openings to retain grease and to permit wastewater flow.
3. Include non-skid cover, recessed lift rings, anchor flange and extension.
4. PDI certified.

#### C. Capacities and Characteristics: Refer to plumbing drawings for information.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install steel grease interceptors and set level and plumb.
- B. Install air control fittings and associated vent piping.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

END OF SECTION 221323

## SECTION 221413 – FACILITY STORM DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
  - 3. Encasement for underground metal piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
  - 1. Storm Drainage Piping: 80 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
- C. Field quality-control inspection and test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, service weight class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO.
      - 2) Fernco, Inc.
      - 3) Ideal Div.; Stant Corp.
      - 4) Mission Rubber Co.
      - 5) Tyler Pipe; Soil Pipe Div.
      - 6) Charlotte Pipe & Foundry Co.
      - 7) Or Approved Equal.
  - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

- a. Manufacturers:
  - 1) ANACO.
  - 2) Clamp-All Corp.
  - 3) Ideal Div.; Stant Corp.
  - 4) Mission Rubber Co.
  - 5) Tyler Pipe; Soil Pipe Div.
  - 6) Charlotte Pipe & Foundry Co.
  - 7) Or Approved Equal.
- 3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
  - a. Manufacturers:
    - 1) MG Piping Products Co.
    - 2) Or approved equal.

### PART 3 - EXECUTION

#### 3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

#### 3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- A. Aboveground storm drainage piping [NPS 6 (DN 150) and smaller] shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Flexible, Shielded, or Rigid, unshielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- B. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
- C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
- D. Underground, storm drainage piping [NPS 8 (DN 200) and larger shall be any of the following:
  - 1. Extra-Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and coupled joints.

### 3.3 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."
- B. Basic piping installation requirements are specified in Division 22 Section "Basic Plumbing Materials and Methods."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- D. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Plumbing Materials and Methods."
- F. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- G. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.



- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.
  - 2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch rod.
  - 4. NPS 6 (DN 150): 60 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

### 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

### 3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

## SECTION 221423 – STORM DRAINAGE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following drainage piping specialties:

- 1. Roof Drains.
- 2. Cleanouts.
- 3. Miscellaneous drainage piping specialties.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Manufacturer Seismic Qualification Certification: Submit certification that all accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

## 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

### 2.1 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains. Refer to plumbing schedule
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
    - a. MIFAB, Inc.
    - b. Jay R. Smith Mfg. Co.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Or Approved Equal.

### 2.2 CLEANOUTS

- A. Metal Floor Cleanouts:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
    - a. MIFAB, Inc.
    - b. Jay R. Smith Mfg. Co.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Or Approved Equal.
- B. Stainless Steel Wall Cleanouts:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
    - a. MIFAB, Inc.
    - b. Jay R. Smith Mfg. Co.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Or Approved Equal.

### 2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch (25 mm)] [2 inches (51 mm)] <Insert dimension> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

B. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout.
3. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
4. Size: Same as or larger than connected downspout.

C. Conductor/Downspout Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

## 2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Install expansion joints, if indicated, in roof drain outlets.
  - 3. Position roof drains for easy access and maintenance.
- C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 (DN 100) and smaller and 100 feet for larger piping.
  - 4. Locate cleanouts at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install test tees in vertical conductors and near floor.
- G. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- H. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

## SECTION 223400 - FUEL-FIRED DOMESTIC-WATER HEATER

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Commercial, gas-fired domestic-water heater.
  - 2. Domestic-water heater accessories.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

#### 1.8 COORDINATION

- A. Coordinate size and location of concrete base with actual equipment provided.

### PART 2 - PRODUCTS

#### 2.1 COMMERCIAL GAS-FIRED DOMESTIC-WATER HEATER

- 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following.
  - a. LAARS
  - b. A.O. Smith



- c. Lochinvar
- d. Or Approved Equal

2. Domestic Hot Water Heater:

- a. Furnish and install a domestic water heater with ASME Construction, & rated input & output & efficiency as scheduled on the plans.
- b. The water heater shall be design certified by CSA International (formerly AGA and CGA) for 180°F (82°C) application, either with or without a separate storage tank.
- c. The water heater tank shall be lined with vitreous enamel and shall have a bolted hand hole cleanout.
- d. Each water heater tank shall have four extruded magnesium anode rods installed in separate head couplings.
- e. Each water heater shall be equipped with stainless steel cold water inlet, sediment reducing cold water inlet tube.
- f. The water heater shall be insulated with Non-CFC foam.
- g. Each water heater shall be equipped with an electronic ignition system, an ASME rated T&P relief valve and a premix closed combustion system for direct venting using 4" CPVC vent pipe.
- h. The water heater shall be factory assembled and tested.
- i. The water heater shall be approved for zero clearance to combustibles.
- j. The control shall be an adjustable electronic thermostat to any temperature up to 180°F.
- k. A recycling Energy Cut Off (E.C.O.) shuts off all gas in the event of an overheat condition. The entire installation shall be made in compliance with state and local codes and ordinances.
- l. The water heater shall require 115V AC.
- m. The water heater shall have standard factory warranty.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tank:

- 1. Description: Steel, ASME construction, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tanks.
- 2. Manufacturers:
  - a. AMTROL Inc.
  - b. Bell & Gossett.
  - c. Armstrong Pumps, Inc.
  - d. Or Approved Equal

3. Construction:

- a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish:
  - c. Air-Charging Valve: Factory installed.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Comply with requirements for shutoff ball valves specified in Section 220523 "Plumbing Valves."
- E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type.
- G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heater specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heater to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heater will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heater on concrete base.
- B. Install domestic-water heater level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff ball valves specified in Section 220523 "Plumbing Valves."
- C. Install gas-fired, domestic-water heater according to NFPA 54.
  1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  3. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 221123 "Facility Natural-Gas Piping."
- D. Install commercial domestic-water heater with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature and pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.
- G. Install thermometer on outlet piping of domestic-water heater. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- I. Fill domestic-water heater with water.
- J. Charge domestic-water expansion tank with air.

### 3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 221123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heater will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, domestic-water heater.

END OF SECTION 223400

## SECTION 224213 – PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
  - 1. Faucet for sink.
  - 2. Sink.
  - 3. Service sink.

#### 1.2 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- C. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Regulatory Requirements: Comply with requirements in ICC A117.1 – 1998 or most current edition, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  - 4. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
  - 5. Vitreous-China Fixtures: ASME A112.19.2M.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - 4. Faucets: ASME A112.18.1.
  - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
  - 6. Hose-Coupling Threads: ASME B1.20.7.
  - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - 8. NSF Potable-Water Materials: NSF 61.
  - 9. Pipe Threads: ASME B1.20.1.
  - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 11. Supply Fittings: ASME A112.18.1.
  - 12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - 1. Atmospheric Vacuum Breakers: ASSE 1001.

2. Brass and Copper Supplies: ASME A112.18.1.
  3. Dishwasher Air-Gap Fittings: ASSE 1021.
  4. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Dishwasher Air-Gap Fittings: ASSE 1021.
  2. Flexible Water Connectors: ASME A112.18.6.
  3. Floor Drains: ASME A112.6.3.
  4. Hose-Coupling Threads: ASME B1.20.7.
  5. Pipe Threads: ASME B1.20.1.
  6. Supply and Drain Protective Shielding Guards: ICC A117.1.

## 1.5 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures of unit shell.
    - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  2. Warranty Period for Commercial Applications: One (1) year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SINK FAUCET (Refer to plumbing schedule)

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Chicago Faucets.
  - c. Delta Faucet Company.
  - d. Elkay Manufacturing Co.
  - e. Kohler Co.
  - f. Sloan Valve Company.
  - g. Or Approved Equal.

2. Faucets: Maximum flow rates shall not exceed 2015 International Plumbing Code Table 604.4.

## 2.2 SINK: (Refer to plumbing schedules)

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - a. Kohler Co.
  - b. American Standard Companies, Inc.
  - c. Elkay Manufacturing Co.
  - d. Or Approved Equal.

## 2.3 SERVICE SINK: (Refer to plumbing schedule)

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - a. Florestone Products Co., Inc.
  - b. Kohler Co.
  - c. American Standard Companies, Inc.
  - d. Or Approved Equal.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install wall-mounting fixtures with tubular waste piping attached to supports.
- C. Install counter-mounting fixtures in and attached to casework.
- D. Install fixtures level and plumb according to roughing-in drawings.
- E. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22.



- F. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- G. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- J. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- K. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- L. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Basic Plumbing Materials and Methods."
- M. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section.
- D. Connect wiring according to Division 26.

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

- E. Install fresh batteries in sensor-operated mechanisms.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucets and strainers, remove sediment and debris, and reinstall strainers and faucets.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213

## SECTION 224716 - WATER COOLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes water coolers with bottle filling stations.

#### 1.3 DEFINITIONS

- A. Accessible water cooler: Fixture that can be approached and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of fixture.
- C. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- C. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

- D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

## PART 2 - PRODUCTS

### 2.1 WATER COOLERS WITH BOTTLE FILLING STATIONS: (Refer to plumbing schedule)

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - a. Elkay Manufacturing Co.
  - b. Haws Corporation.
  - c. Oasis Corporation.
  - d. Halsey Taylor.
  - e. Or Approved Equal.

### 2.2 PRODUCT SPECIFICATION

- 1. Unit shall include an electric water cooler with bottle filling station. Unit shall deliver 8 GPH of 50°F of drinking water at 90°F ambient and 80°F inlet water. Lower unit shall have pushbar activation.
- 2. Bottle filling unit shall include an electronic sensor for touchless activation with an automatic 20-second shut-off timer. LED light shall illuminate the water dispensing area, brightening as water is being dispensed.
- 3. Unit shall include a Green Ticker™ displaying count of plastic bottles saved from waste.
- 4. Bottle filler shall provide a 1.1 - 1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall include the WaterSentry® Plus 3000-gallon capacity filter, certified to NSF/ANSI 42 & 53, with visual filter monitor to indicate when replacement is necessary.
- 5. Unit shall automatically detect a new filter and reset visual filter monitor accordingly.
- 6. Unit shall have the ability to turn off refrigeration system as needed, in addition to self-diagnosing system issues and display messages related.
- 7. Unit shall include integrated silver ion anti-microbial protection in key areas.
- 8. Unit shall meet ADA guidelines.
- 9. Unit shall be a lead-free design which shall be certified to NSF/ANSI 61 and 372 and meets Federal and State low-lead requirements.
- 10. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120 and shall be FCC compliant.

## 2.3 STANDARD FEATURES

- Sanitary, touchless activation with auto 20-second shut-off (Bottle Filler)
- Easy-touch front and side pushbar controls (Cooler)
  - Visual User Interface display includes: Innovative Green Ticker™ counts bottles saved from waste
  - LED Visual Filter Monitor shows when replacement is necessary
- WaterSentry® Plus 3000-gallon capacity Filtration System, certified to NSF/ANSI 42 & 53 (Lead, Class 1 Particulate, Chlorine, Taste & Odor)
- Integrated Silver Ion Anti-microbial Protection in key areas
- Quick Fill Rate: 1.1 gpm
- Laminar Flow provides minimal splash
- Vandal-Resistant bubbler
- Real Drain System eliminates standing water
- Cooler panel finishes: Stainless Steel
- Automatic filter status reset with each filter change

## 2.4 COOLING SYSTEM

- Compressor: hermetically-sealed, reciprocating type, single phase. Sealed-in lifetime lubrication.
- Condenser: Fan cooled, copper tube with aluminum fins. Fan motor shall be permanently lubricated.
- Cooling Unit: Combination tube-tank type. Self-cleansing. Continuous copper tubing with stainless steel tank. Fully insulated with EPS foam which meets UL requirements for self-extinguishing material.
- Refrigerant Control: Refrigerant R134a shall be controlled by accurately calibrated capillary tube.
- Temperature Control: Electronic temperature control requires no adjustment
- Temperature Sensing Device: Fully solid-state temperature sensing has no moving parts.

## 2.5 CONSTRUCTION

- Stainless Steel basin with integral drain.

- Galvanized structural steel cooler chassis provides structural integrity.
- Stainless Steel bottle filler wrapper with ABS plastic alcove.
- Cooler cabinet shall be Stainless Steel construction.
- Vandal-resistant bubbler shall be one-piece, heavy-duty construction.

## 2.6 REPLACEMENT FILTERS

1. 51300C\_12PK (twelve) for each unit.

## 2.7 WARRANTY

1. 5-year limited warranty shall be provided on the unit's refrigeration system. Electrical components and water system shall be warranted for 12 months from date of installation or 18 months from factory shipment, whichever date falls first.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATIONS

- A. Use mounting frames for water coolers, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

## 3.3 INSTALLATION

- A. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "Plumbing Valves."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Basic Plumbing Materials and Methods."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealers."

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
  - 1. Remove and replace malfunctioning units and retest as specified above.
  - 2. Report test results in writing.

### 3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

### 3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224716





## SECTION 230000 – MECHANICAL SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - a. Work covered under Mechanical Contract.
  - b. Work under other contracts.
  - c. Use of premises.
  - d. Owner's occupancy requirements.
  - e. Specification formats and conventions.

- B. Related Sections include the following:

- a. Division 23 Sections.

#### 1.3 WORK COVERED UNDER MECHANICAL CONTRACT

- A. Provide all labor, materials, tools, machinery, equipment, and services necessary to complete the mechanical and DDC work under this contract. All systems and equipment shall be complete in every aspect and all items of material, equipment, and labor shall be provided for a fully operational system. Coordinate the work with work of other trades so as to resolve conflicts without impeding job progress. The mechanical work includes the following:

- B. MECHANICAL

- 1. The mechanical contractor shall furnish all labor, materials, equipment, rigging, appliances, tools and accessories required for providing, installing, connecting and testing the new mechanical system, associated work, controls, etc., in accordance with these specifications and the applicable drawings. The work includes:
    - a. Remove existing HV/HVAC mechanical equipment as shown on the drawings, complete with associated ductwork, air inlets/outlets, dampers, louvers, piping, valves, insulation, supports, thermostats, electricals, controls, etc.
    - b. Remove existing unit ventilators, complete with existing piping, valves, louvers, insulation, supports, electrical, controls, thermostats, etc.
    - c. Remove existing exhaust fans, roof vents, etc., complete with existing roof curbs, ductwork, air inlets/outlets, supports, electrical, controls, etc.
    - d. Remove existing ductwork and air inlets/outlets as called out on plans, complete existing dampers, insulation, supports, etc.

- e. Remove existing abandoned steam radiators, complete with existing enclosures, piping, valves, steam traps, insulation, supports, controls, etc.
- f. Remove existing louvers as called out on the drawings, complete with existing ductwork, dampers, etc. Infill wall openings. Refer to architectural drawings for additional information.
- g. Remove existing piping as called out on the drawings, complete with existing insulation, valves, supports, etc.
- h. Removed all existing controls and wiring associated with demolished mechanical equipment, thermostats, etc.
- i. Remove existing controls on existing mechanical/HV/HVAC units throughout entire school as indicated on the drawings, complete with associated controls, control valves, actuators, thermostats, sensors, etc.
- j. Remove all demolished equipment and debris from the site in accordance with all State and Local regulations.
- k. Coordinate all removals as further scheduled on the drawings so as not to interfere with Owner's use of the building.
- l. Furnish and install new packaged rooftop unit as scheduled on the drawings, complete with spring vibration isolation roof curb, supports, VFD's, ductwork, gas piping, insulation of all ductwork, air outlets/ inlets, dampers, DDC controls, etc. for a complete and operational system
- m. Furnish and install new HV/HVAC mechanical equipment as scheduled on the plans, complete with new ductwork, piping, insulation, DDC controls, electrical, etc. for a complete and operational system.
- n. Furnish and install new kitchen makeup air unit and exhaust fan as scheduled on the drawings, complete with roof curbs, supports, VFD's, ductwork, gas piping, insulation of all ductwork, air outlets/ inlets, dampers, DDC controls, etc. for a complete and operational system.
- o. Furnish and install new DX split/heat pump system with indoor/outdoor units as scheduled on the drawings, complete with roof support curbs, supports, fresh air intake ductwork (where indicated on the drawings), refrigerant piping, condensate drain piping, condensate pumps, insulation of all piping/ductwork, valves, gauges, controls, sensors, etc. for a complete and operational system.
- p. **Contractor to note that, hoisting/rigging work needs to be performed after school hours or on a weekend. Coordinate schedule with Owner.**
- q. Furnish and install new unit ventilators, complete with piping, valves, wall boxes, louvers, insulation, supports, wiring, thermostats, electrical, DDC controls, etc. for a complete and operational system. Unit color to be selected by the owner.
- r. Furnish and install exhaust fans complete with supports, vibration isolators, acoustical housing, fan switch, interlock wiring, backdraft dampers, etc. for a complete and operational system

- s. Furnish and install new cabinet heaters, complete with piping, valves, insulation, supports, wiring, thermostats, disconnect switches, DDC controls, etc. for a complete and operational system. Color to be selected by the owner
- t. Furnish and install new exhaust fans complete with supports, vibration isolators, fan switch, interlock wiring, backdraft dampers, etc. for a complete and operational system.
- u. Furnish and install new duct silencers as scheduled on plans.
- v. **All electrical work associated with new HV/HVAC system shall be performed by the Electrical Subcontractor. Refer to electrical drawings and Division 26 specification sections for information.**
- w. Furnish and install new "Andover" DDC controllers and controls for existing mechanical/HV/HVAC units as indicated on the drawings, complete with control valves, actuators, thermostats, sensors, etc. for a complete and operational DDC control system
- x. Furnish and install new "Andover" DDC controllers and controls for new equipment as indicated on the drawings, complete with control valves, actuators, thermostats, sensors, etc. Connect new controls to existing "Andover" building management system (BMS).

All DDC controls shall be provided and field installed by DDC subcontractor and shall be tied into the existing School District's "Andover" building management system (BMS). All new controls and input/output points for all equipment shall be compatible with the existing BMS.

- y. All DDC controls, control valves, and wall thermostats shall be provided by Control subcontractor and integrated with existing DDC system to avoid complexity of individual control systems and systems fighting each other. This will ensure optimal energy performance.
- z. All electrical power supply work required for new DDC system shall be performed by the Electrical subcontractor. All low-voltage power supply and wiring work required for new DDC system shall be performed by the DDC control subcontractor.
- aa. Furnish and install new supply, return, exhaust and outdoor air ductwork as indicated on the drawings. All ductwork shall be galvanized steel construction.
- bb. All new supply, return, exhaust and outdoor air ductwork shall be internally or externally insulated as indicated on drawings. All internally lined ductwork shall be provided with IAQ liner.
- cc. Furnish and install new grease exhaust air ductwork for kitchen hood as indicated on the drawings, complete with insulation, supports, cleanouts, etc.
- dd. Provide high-efficiency electric motors for all new units.
- ee. Furnish and install motorized dampers, volume dampers.
- ff. Furnish and install fire dampers of suitable rating at all duct penetrations through all rated partitions (walls/slab), whether indicated on the drawings or not.

- gg. Furnish and install flexible duct connectors at all duct connections to all HV/HVAC units.
- hh. Provide fire stopping for all duct and piping penetrations through rated walls/slabs with pipe escutcheons
- ii. Furnish and install supply and return piping, complete with manual shut-off/temperature balancing valves, check valves, control valves, temperature gauges, union connections, insulation, etc. for a complete operating system. Provide manual isolation valve (on supply) and manual balancing valve (on return) for each terminal unit connection.
- jj. Provide automatic and manual air vents at the top of piping risers/headers, at high points in the system.
- kk. All cutting, patching and alteration work shall be performed.
- ll. Furnish and install all ancillary equipment needed for a complete and proper installation including, but not limited to anchors, hangers, expansion loops, fittings, strainers, valves, unions, etc.
- mm. All ductwork shall be properly fabricated, installed and supported as per SMACNA and ASHRAE guidelines
- nn. Contractor to perform testing, adjusting and balancing (TAB) of the entire HV/HVAC system shown on the drawings, including all new HV/HVAC units, air and water side distributions, air outlets/inlets, etc. **Submit four (4) sets of air and unit TAB reports for review.**
- oo. Provide testing, commissioning and start-up reports for all new mechanical/HV system installed in this project.
- pp. The entire new piping system shall be hydrostatically tested for a minimum of two (2) hours at a minimum of 150 psig or 1.5 times the working pressure, whichever is higher. **Submit four (4) sets of pressure testing report for review.**
- qq. Submit six (6) sets of shop drawings of all equipments, sheet metal standards, piping standards, equipment layout, detailed duct and piping layouts, air inlets, supports, DDC controls, electrical, wiring diagram, etc.
- rr. Contractor to prepare as-built drawings of the entire mechanical/HV system. **Submit four (4) sets of Operation and Maintenance Manuals.**
- ss. Contractor to perform testing, adjusting and balancing (TAB) of the entire HVAC/HV/Mechanical system, including all new rooftop units, cabinet heaters, air side distribution, air outlets/inlets, water side distribution, heating pumps, finned tube elements/baseboards, etc. TAB on new rooftop units shall include detailed performance verification (cooling capacity, heating capacity, enthalpy wheel performance, individual pressure drops, amp readings, CFM's, etc.) which will need to be done during respective cooling, heating, and transitional seasons. **Submit four (4) sets of air, water and unit TAB reports for review.**
- tt. Detailed Performance Testing, Adjusting and Balancing (TAB) shall be done during the respective season for the units, during the summer season for cooling mode, during winter for heating mode, and during fall/spring for free cooling mode.

- uu. Provide color coded identification tags, identification markers and equipment tags for all equipment including RTU, HVAC units, fans, ductwork, piping, valves, control valves, etc.
- vv. Warranty: The entire system shall be warranted for a period of two (2) complete years from the date of acceptance by the owner, including all materials and labor components.
- ww. **Commissioning:** The following is the commissioning scope of work for this project:
  - 1. There will not be a separate commissioning agent on this project. The architect/engineer will oversee the commissioning process.
  - 2. Submittals/Shop Drawings shall include detailed start up procedures.
  - 3. All equipment shall be factory tested before being shipped to project site.
  - 4. Perform functional performance test (FPT) of all HV/HVAC systems and equipment. Submit FPT Reports.
  - 5. Provide detailed Start-Up Reports.
  - 6. Trending: The building control system/energy management system, shall be monitored for the first year by the Controls Contractor, as well as by the Owner/Owner designated team for proper operation to optimize energy performance without compromising the comfort conditions.
  - 7. The contractor shall certify in writing that the entire work was completed and systems are operational according to the contract documents, including calibration of instrumentation and controls.
  - 8. Schedule, witness and document tests, inspections and systems startup. Inform architect/engineer sufficiently in advance to enable them to witness startup.
  - 9. Perform testing, adjusting and balancing of all airside, waterside, and units/systems.
  - 10. Compile test data, inspection reports and certificates and include them in the Systems Manual and Commissioning Report.
  - 11. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
  - 12. Prepare as-built drawings. Submit four (4) sets of each, along with two (2) CD's (for drawings).
  - 13. Conduct Operation and Maintenance Training Programs, to be provided by qualified instructors for all HV/HVAC systems and equipment. Videotape and edit training sessions. Submit two (2) videotapes for Owners future use and reference.
  - 14. Submit six (6) sets of all documents.

#### 1.4 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 USE OF PREMISES

- A. General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - a. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
  - b. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
  - a. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - b. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - a. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
  - b. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
  - c. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

## 1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.
  - a. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - b. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - a. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - b. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230000





## SECTION 230130 – EXISTING HVAC AIR DUCT CLEANING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes cleaning of the following existing ductwork distribution system in Auditorium and Gymnasium:
  - 1. Supply system.
  - 2. Return system.
  - 3. Exhaust system.
- B. Refer to drawings for areas/locations of existing ductwork distribution system.

#### 1.3 DEFINITIONS

- A. ASCS: Air system cleaning specialist.
- B. NADCA: National Air Duct Cleaners Association.
- C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

#### 1.4 SUBMITTALS

- A. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
- B. Qualification Data: For ASCS.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. ASCS Qualifications: A member of a nationally recognized nonprofit industry organization dedicated to the cleaning of HVAC systems.
  - 1. Certification: Employ an ASCS certified by NADCA or a nationally recognized certification program.
  - 2. Supervisor Qualifications: Certified by a nationally recognized program and organization.
  - 3. Experience: Submit records of experience in the field of HVAC systems cleaning.

4. Equipment, Materials, and Labor: Have equipment, materials, and labor required to perform specified services.
- B. Comply with current published standards of NADCA.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized-Steel Sheet: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### 2.3 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Rectangular Duct Door: Double wall; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
1. Manufacturers:
    - a. American Warming and Ventilating.
    - b. Cesco Products.
    - c. Ductmate Industries, Inc.
    - d. Flexmaster U.S.A., Inc.
    - e. Greenheck.

- f. McGill AirFlow Corporation.
  - g. Nailor Industries Inc.
  - h. Ventfabrics, Inc.
  - i. Ward Industries, Inc.
  - j. Or Approved Equal.
- 2. Frame: Galvanized-steel sheet; with bend over tabs and foam gaskets.
- 3. Provide number of hinges and locks as follows:
  - a. Less Than 12 Inches Square: Secure with two sash locks.
  - b. Up to 18 Inches Square: Two hinges and two sash locks.
  - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
- C. Round Duct Door: Double wall; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
  - 1. Manufacturers:
    - a. Flexmaster U.S.A., Inc.
    - b. Or Approved Equal.
  - 2. Frame: Galvanized-steel sheet; with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch thick fibrous-glass or polystyrene-foam board.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine systems to determine appropriate methods, tools, and equipment required for performance of work.
- B. Prepare written report listing conditions detrimental to performance of work.
- C. Proceed with work only after unsatisfactory conditions have been corrected.

### 3.2 CLEANING

- A. Engage a qualified ASCS to clean the following existing systems:
  - 1. Supply system.
  - 2. Return system.
  - 3. Exhaust system.
- B. Perform cleaning before air balancing or mark position of dampers and air-directional mechanical devices before cleaning.

- C. Use duct-mounted access doors, as required, for physical and mechanical entry and for inspection.
  - 1. Install additional duct-mounting access doors to comply with duct cleaning standards.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection. Replace damaged and deteriorated flexible ducts.
  - 3. Reseal rigid-fiberglass-duct systems according to NAIMA recommended practices.
  - 4. Remove and reinstall ceiling components to gain access for duct cleaning. Clean ceiling components after they have been removed and replaced.
- D. Mark position of dampers and air-directional mechanical devices before cleaning and restore to their marked position on completion.
- E. Particulate Collection and Odor Control:
  - 1. Where venting vacuuming system inside building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater) particles.
  - 2. When venting vacuuming system outside building, use filtration to contain debris removed from the HVAC system and locate exhaust down wind and away from air intakes and other points of entry into building.
- F. Clean the following metal-duct system components by removing visible surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Existing supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Coils and related components.
  - 4. Return-air ducts, dampers, and actuators, except in ceiling plenums and mechanical room.
  - 5. Supply-air ducts, dampers, actuators, and turning vanes.
  - 6. Dedicated exhaust and ventilation components.
- G. Mechanical Cleaning Methodology:
  - 1. Clean metal-duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of ducts so areas being cleaned are under negative pressure.
  - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct liner.
  - 4. Provide operative drainage system for washdown procedures.
  - 5. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present; use according to manufacturer's written instructions after removal of surface deposits and debris.
- H. Cleanliness Verification:
  - 1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
  - 2. Visually inspect metal-duct systems for contaminants.
  - 3. Where contaminants are discovered, reclean and reinspect duct systems.

### 3.3 DUCT ACCESSORIES INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install duct-mounting access doors where access doors do not currently exist to allow for the cleaning of ducts, accessories, and terminal units as follows:
  - 1. On both sides of duct coils.
  - 2. Downstream from volume dampers, turning vanes, and equipment.
  - 3. Adjacent to fire or smoke dampers; reset or install new fusible links.
  - 4. Before and after each change in direction, at maximum 50-foot (15-m) spacing.
  - 5. On sides of ducts where adequate clearance is available.
- D. Install the following sizes for duct-mounting, rectangular access doors:
  - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
  - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
  - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
  - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
  - 5. Body Access: 25 by 14 inches (635 by 355 mm).
  - 6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

### 3.4 CONNECTIONS

- A. Reconnect ducts to fans and air-handling units with existing flexible connectors after cleaning ducts and flexible connectors. Replace existing damaged and deteriorated flexible connectors.
- B. For fans developing static pressures of 5-inch wg (1250 Pa) and higher, cover replacement flexible connectors with loaded vinyl sheet held in place with metal straps.
- C. Reconnect terminal units to supply ducts with existing flexible ducts or replace damaged and deteriorated existing flexible ducts with maximum 12-inch (300-mm) lengths of new flexible duct.
- D. Reconnect diffusers or light troffer boots to low-pressure ducts with existing flexible ducts or replace damaged and deteriorated existing flexible ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- E. Reconnect existing and new flexible ducts to metal ducts with adhesive plus sheet metal screws.

### 3.5 FIELD QUALITY CONTROL

- A. Verification of Coil Cleaning: Cleaning shall restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil

will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

- B. Report results of tests in writing. Include photo documentation showing ductwork before and after cleaning.

END OF SECTION 230130

## SECTION 230500 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Mechanical demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Painting and finishing.
  - 11. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for **250-psig (1725-kPa)** minimum working pressure at **180 deg F (82 deg C)**.
  - 1. Acceptable Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Eclipse, Inc.
    - c. Epco Sales, Inc.
    - d. Hart Industries, International, Inc.
    - e. Watts Industries, Inc.; Water Products Div.
    - f. Zurn Industries, Inc.; Wilkins Div.
    - g. Or Approved Equal.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for **150- or 300-psig (1035- or 2070-kPa)** minimum working pressure as required to suit system pressures.
  - 1. Acceptable Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Or Approved Equal.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Acceptable Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Pipeline Seal and Insulator, Inc.
    - d. Or Approved Equal.
  - 2. Separate companion flanges and steel bolts and nuts shall have **150- or 300-psig (1035- or 2070-kPa)** minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and **300-psig (2070-kPa)** minimum working pressure at **225 deg F (107 deg C)**.
  - 1. Acceptable Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Epco Sales, Inc.

- d. Or Approved Equal.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Acceptable Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.
    - e. Or Approved Equal.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Acceptable Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or Approved Equal.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.

- G. Molded PE: Reusable, PE, tapered-cup shaped and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 MECHANICAL DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

- a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
- b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
- c. Insulated Piping: One-piece, stamped-steel type with spring clips.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
- l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
- b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
- g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
- h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
- i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
- j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
- k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. PVC Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.
    - b. Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than **6 inches (150 mm)** in diameter.
  2. Install cast-iron "wall pipes" for sleeves **6 inches (150 mm)** and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.



- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09 Sections "Interior Painting"
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.9 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout around anchors.

G. Cure placed grout.

END OF SECTION 230500

## SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general requirements for single phase and polyphase, general purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe duty motors.

#### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

#### 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.
  - 2. Energy and Premium Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

#### 2.5 SINGLE PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent split capacitor.
  2. Split phase.
  3. Capacitor start, inductor run.
  4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable torque, permanent split capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513



## SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Dial type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Sight flow indicators.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of meter and gage, from manufacturer.
- C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal Case, Industrial Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Flo Fab Inc.
    - b. Terice, H. O. Co.
    - c. Weiss Instruments, Inc.
    - d. Winters Instruments - U.S.
    - e. Or Approved Equal.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 7 inch nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.2 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat Transfer Medium: Mixture of graphite and glycerin.

## 2.3 PRESSURE GAGES

### A. Direct Mounted, Metal Case, Dial Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AMETEK, Inc.; U.S. Gauge
  - b. Flo Fab Inc.
  - c. Trerice, H. O. Co.
  - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.



- e. Weiss Instruments, Inc.
  - f. Winters Instruments - U.S.
  - g. Or Approved Equal.
- 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2 inch nominal diameter.
  - 4. Pressure Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom outlet type unless back outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  - 8. Pointer: Dark colored metal.
  - 9. Window: Glass or plastic.
  - 10. Ring: Metal.
  - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

#### 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston type surge dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

#### 2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Terice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
  - 9. Or Approved Equal.
- B. Description: Test station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## 2.6 TEST PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Trerice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
  - 9. Or Approved Equal.
- B. Furnish one test plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1 to 2 inch diameter dial and tapered end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. Pressure Gage: Small, Bourdon tube insertion type with 2 to 3 inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

## 2.7 SIGHT FLOW INDICATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Archon Industries, Inc.
  - 2. Dwyer Instruments, Inc.
  - 3. Emerson Process Management; Brooks Instrument
  - 4. Ernst Co., John C., Inc.
  - 5. Ernst Flow Industries
  - 6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
  - 7. OPW Engineered Systems; a Dover company
  - 8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown
  - 9. Or Approved Equal.
- B. Description: Piping inline installation device for visual verification of flow.
- C. Construction: Bronze or stainless steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- D. Minimum Pressure Rating: 150 psig.
- E. Minimum Temperature Rating: 200 deg F.
- F. End Connections for NPS 2 and Smaller: Threaded.

- G. End Connections for NPS 2-1/2 and Larger: Flanged.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat transfer medium.
- E. Install direct mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install flow indicators in piping systems in accessible positions for easy viewing.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled Water Piping: 0 to 250 deg F.
- B. Scale Range for Heating, Hot Water Piping: 0 to 250 deg F.

### 3.5 PRESSURE GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled Water Piping: 0 to 100 psi.
- B. Scale Range for Heating, Hot Water Piping: 0 to 100 psi.

END OF SECTION 230519



## SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following general-duty valves:
  - 1. Copper-alloy ball valves.
  - 2. Ferrous-alloy ball valves.
  - 3. Bronze check valves.
  - 4. Ferrous-alloy wafer check valves.
  - 5. Spring-loaded, lift-disc check valves.
  - 6. Bronze gate valves.
  - 7. Cast-iron gate valves.
  - 8. Bronze globe valves.
  - 9. Cast-iron globe valves.
- B. Related Sections include the following:
  - 1. Division 23 Section "Mechanical Identification" for valve tags and charts.
  - 2. Division 23 Section "Direct Digital Control System for HVAC" for control valves and actuators.
  - 3. Division 23 piping Sections for specialty valves applicable to those Sections only.

#### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PTFE: Polytetrafluoroethylene plastic.
  - 5. SWP: Steam working pressure.
  - 6. TFE: Tetrafluoroethylene plastic.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions;

and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

## 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  - 1. Chain wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
  - 2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
  - 3. Hand wheel: For valves other than quarter-turn types.
  - 4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
  - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Grooved Ends: AWWA C606.
  - 1. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
  - 2. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

## 2.3 COPPER-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. One-Piece, Copper-Alloy Ball Valves:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Grinnell Corporation.
    - d. Jamesbury, Inc.
    - e. Kitz Corporation of America.

- f. Legend Valve & Fitting, Inc.
- g. NIBCO INC.
- h. Watts Industries, Inc.; Water Products Div.
- i. Or Approved Equal.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats.

## 2.4 FERROUS-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

- 1. American Valve, Inc.
- 2. Conbraco Industries, Inc.; Apollo Div.
- 3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- 4. Flow-Tek, Inc.
- 5. Foster Valve Co.
- 6. Kitz Corporation of America.
- 7. KTM Products, Inc.
- 8. McCANNA, Incorporated.
- 9. Milwaukee Valve Company.
- 10. NIBCO INC.
- 11. PBM, Inc.
- 12. Richards Industries; Marwin Ball Valves.
- 13. Worcester Controls.
- 14. Or Approved Equal.

C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

D. Ferrous-Alloy Ball Valves: Class 150, full or regular port.

## 2.5 BRONZE CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

- 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
  - a. Cincinnati Valve Co.
  - b. Red-White Valve Corp.
  - c. Walworth Co.
  - d. Or Approved Equal.
- 2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
  - a. Cincinnati Valve Co.



- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Red-White Valve Corp.
- d. Or Approved Equal.

3. Type 3, Bronze, Swing Check Valves with Metal Disc:

- a. American Valve, Inc.
- b. Cincinnati Valve Co.
- c. Kitz Corporation of America.
- d. Legend Valve & Fitting, Inc.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell, Wm. Co.
- h. Red-White Valve Corp.
- i. Walworth Co.
- j. Watts Industries, Inc.; Water Products Div.
- k. Or Approved Equal.

C. Bronze Check Valves, General: MSS SP-80.

D. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

E. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

F. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

## 2.6 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Gulf Valve Co.
- c. Valve and Primer Corp.
- d. Or Approved Equal.

2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Gulf Valve Co.
- c. Techno Corp.
- d. Or Approved Equal.

C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

## 2.7 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Wafer Lift-Disc Check Valves:

a. Mueller Steam Specialty.

2. Type II, Compact-Wafer, Lift-Disc Check Valves:

- a. Durabla Fluid Technology, Inc.
- b. Flomatic Valves.
- c. GA Industries, Inc.
- d. Grinnell Corporation.
- e. Metraflex Co.
- f. Milwaukee Valve Company.
- g. Mueller Steam Specialty.
- h. Multiplex Manufacturing Co.
- i. NIBCO INC.
- j. SSI Equipment, Inc.
- k. Val-Matic Valve & Mfg. Corp.
- l. Valve and Primer Corp.
- m. Or Approved Equal.

3. Type III, Globe Lift-Disc Check Valves:

- a. Durabla Fluid Technology, Inc.
- b. Flomatic Valves.
- c. GA Industries, Inc.
- d. Grinnell Corporation.
- e. Metraflex Co.
- f. Milwaukee Valve Company.
- g. Multiplex Manufacturing Co.
- h. NIBCO INC.
- i. SSI Equipment, Inc.
- j. Val-Matic Valve & Mfg. Corp.
- k. Valve and Primer Corp.
- l. Or Approved Equal.

4. Type IV, Threaded Lift-Disc Check Valves:

- a. Check-All Valve Mfg. Co.
- b. Durabla Fluid Technology, Inc.
- c. Grinnell Corporation.
- d. Legend Valve & Fitting, Inc.
- e. Metraflex Co.
- f. Milwaukee Valve Company.
- g. Mueller Steam Specialty.
- h. NIBCO INC.
- i. Watts Industries, Inc.; Water Products Div.
- j. Or Approved Equal.

- C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
- D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
- E. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- F. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
- G. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

## 2.8 BRONZE GLOBE VALVES

A. Available Manufacturers:

B. Manufacturers:

### 1. Type 1, Bronze Globe Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Kitz Corporation of America.
- d. Legend Valve & Fitting, Inc.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell, Wm. Co.
- h. Red-White Valve Corp.
- i. Walworth Co.
- j. Or Approved Equal.

### 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Kitz Corporation of America.
- d. McWane, Inc.; Kennedy Valve Div.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell, Wm. Co.
- h. Red-White Valve Corp.
- i. Walworth Co.
- j. Or Approved Equal.

### 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

- a. Cincinnati Valve Co.
- b. Grinnell Corporation.
- c. Milwaukee Valve Company.

- d. NIBCO INC.
  - e. Walworth Co.
  - f. Or Approved Equal.
- C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.
- D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.
- E. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

## 2.9 CAST-IRON GLOBE VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Type I, Cast-Iron Globe Valves with Metal Seats:
    - a. Cincinnati Valve Co.
    - b. Grinnell Corporation.
    - c. Kitz Corporation of America.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. Powell, Wm. Co.
    - g. Red-White Valve Corp.
    - h. Walworth Co.
    - i. Or Approved Equal.
- C. Cast-Iron Globe Valves, General: MSS SP-85.
- D. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.

- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball valves.
  - 2. Throttling Service: Ball or globe valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Heating Water Piping: Use the following types of valves:
  - 1. Ball Valves, NPS 2 (DN 50) and Smaller: One or Two-piece, CWP rating, copper alloy.
  - 2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
  - 3. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal / vertical, bronze.
  - 4. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
  - 5. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
  - 6. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Single / Dual-plate, wafer-lug/ double-flanged, Class 150, ferrous alloy.
  - 7. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
  - 8. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
  - 9. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2 / 3, Class 150, bronze.
  - 10. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
  - 11. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
  - 12. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.

- F. Install chainwheel operators on valves NPS 4 (DN 100) and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

## SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

- B. Related Sections:

1. Section 230548 "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Fiberglass strut systems.
  - 4. Pipe stands.
  - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot-dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:



1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
  - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
  - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting".
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529



## SECTION 230548 - MECHANICAL VIBRATION AND SEISMIC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Elastomeric isolation pads and mounts.
  - 2. Restrained elastomeric isolation mounts.
  - 3. Freestanding and restrained spring isolators.
  - 4. Housed spring mounts.
  - 5. Elastomeric hangers.
  - 6. Spring hangers.
  - 7. Spring hangers with vertical-limit stops.
  - 8. Thrust limits.
  - 9. Pipe riser resilient supports.
  - 10. Resilient pipe guides.
  - 11. Freestanding and restrained air spring isolators.
  - 12. Restrained vibration isolation roof-curb rails.
  - 13. Seismic snubbers.
  - 14. Restraining cables.
  - 15. Steel and inertia, vibration isolation equipment bases.

#### 1.3 DEFINITIONS

- A.  $A_v$ : Effective peak velocity related acceleration coefficient.

#### 1.4 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and

- rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.
- C. Welding certificates.
- D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping tests performed by an independent laboratory or acoustician.
- E. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
- 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

## 1.5 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."

## 1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 VIBRATION ISOLATORS

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Kinetics Noise Control, Inc.
  - 2. Mason Industries, Inc.
  - 3. Vibration Eliminator Co., Inc.
  - 4. Vibration Isolation Co., Inc.
  - 5. Or Approved Equal.
- C. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
  - 1. Material: Standard neoprene or Natural rubber.
  - 2. Number of Layers: Multiple.
- D. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
  - 1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
  - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- G. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.3 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers:
- B. Manufacturers:
1. Mason Industries, Inc.
  2. Kinetics Noise Control, Inc.
  3. Vibration Eliminator Co., Inc.
  4. Vibration Isolation Co., Inc.
  5. Or Approved Equal.

## 2.4 VIBRATION ISOLATION EQUIPMENT BASES

- A. Available Manufacturers:
- B. Manufacturers:
1. Mason Industries, Inc.
  2. Vibration Eliminator Co., Inc.
  3. Vibration Isolation Co., Inc.
  4. Or Approved Equal.

## 2.5 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
  2. All hardware shall be electro-galvanized. Hot-dip galvanized metal components for exterior use.
  3. Baked enamel for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- B. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- C. Install resilient bolt isolation washers on equipment anchor bolts.

### 3.3 EQUIPMENT BASES

- A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.
- B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
  1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Perform the following field quality-control testing:
  - 1. Isolator seismic-restraint clearance.
  - 2. Isolator deflection.
  - 3. Snubber minimum clearances.
  - 4. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 5. Air-Mounting System Operational Test: Test the compressed-air leveling system. Remove malfunctioning units, replace with new units, and retest.
  - 6. Test and adjust air-mounting system controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Air-Mounting System Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping connections. Report results in writing.
  - 1. Isolator seismic-restraint clearance.
  - 2. Isolator deflection.
  - 3. Snubber minimum clearances.
  - 4. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 5. Operational Test: Test the compressed-air leveling system. Remove malfunctioning units, replace with new units, and retest.
  - 6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.5 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust air spring leveling mechanism.
- E. Adjust active height of spring isolators.
- F. Adjust snubbers according to manufacturer's written recommendations.
- G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

- H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

### 3.6 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 1 Section "Closeout Procedures"

END OF SECTION 230548





## SECTION 230553 - MECHANICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
  - 1. Equipment nameplates.
  - 2. Equipment markers.
  - 3. Equipment signs.
  - 4. Access panel and door markers.
  - 5. Pipe markers.
  - 6. Duct markers.
  - 7. Stencils.
  - 8. Warning tags.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.

#### 1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

#### 1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Thickness: 1/8 inch, unless otherwise indicated.
  - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Precoiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## 2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

## 2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
  - 1. Stencil Material: Metal or fiberboard, Aluminum, or Brass.
  - 2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

## 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.
  - 1. Material: 0.032-inch thick brass or aluminum.
  - 2. Material: 0.0375-inch thick stainless steel.
  - 3. Material: 3/32-inch thick laminated plastic with 2 black surfaces and white inner layer.
  - 4. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

## 2.6 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
  - 2. Frame: Extruded aluminum.
  - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

## 2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  - 4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where

not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, and stills.
2. Pumps, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
  - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
  - b. Meters, gages, thermometers, and similar units.
  - c. Fuel-burning units, including boilers, furnaces, and heaters.
  - d. Pumps and similar motor-driven units.
  - e. Heat exchangers, coils, and similar equipment.
  - f. Fans, blowers, primary balancing dampers, and mixing boxes.
  - g. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
  - h. Strainers, filters, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
  - a. Green: For cooling equipment and components.
  - b. Yellow: For heating equipment and components.
  - c. Green and Yellow or Orange: For combination cooling and heating equipment and components.
2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

4. Include signs for the following general categories of equipment:
  - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
  - b. Fuel-burning units, including boilers, furnaces, and heaters.
  - c. Pumps and similar motor-driven units.
  - d. Heat exchangers, coils, evaporators, and similar equipment.
  - e. Fans, blowers, primary balancing dampers, and mixing boxes.
  - f. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
  - g. Strainers, filters, water-treatment systems, and similar equipment.
- E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- F. Install access panel markers with screws on equipment access panels.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
  1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
  2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.
  1. Identification Paint: Use for contrasting background.
  2. Stencil Paint: Use for pipe marking.
- C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
  - 1. Green: For cold-air supply ducts.
  - 2. Yellow: For hot-air supply ducts.
  - 3. Blue: For exhaust, outside, relief, return, and mixed-air ducts.
  - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
  - 5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

### 3.6 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

### 3.7 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553





## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
  - 3. Additional Tests
    - a. Sound testing.
    - b. Vibration testing.
    - c. Duct leakage testing.
    - d. Controls verification.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. T&B: Testing, adjusting, and balancing
- C. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.
- D. TBE: AABC certified test and balance engineer.
- E. TBT: AABC certified test and balance technician.
- F. HVAC: Heating, ventilating, and air conditioning.
- G. BAS: Building automation systems.
- H. Contract documents: the mechanical drawings and test and balance specification
- I. NC: noise criteria

- J. RC: room criteria

#### 1.4 T&B INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor's expense.
- B. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article.
- C. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.
- D. Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.
- E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-certified T&B report.
  - 1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.

#### 1.5 QUALITY ASSURANCE

- A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.
  - 1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
  - 2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.
- B. T&B Conference: If requested by the Engineer or Owner after approval of the T&B Agency's submittals, meet to develop a mutual understanding of the details. The T&B agency shall be provided a minimum of 14 days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The examination report.
    - b. The Strategies and Procedures plan.
    - c. Systems readiness checklists.
    - d. Coordination and cooperation of trades and subcontractors.
    - e. Coordination of documentation and communication flow.
- C. TBT shall perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.
  - 2. Certify that the T&B team complied with the approved T&B plan and the procedures specified and referenced in this Specification.

3. Certify the T&B report.

D. T&B Report Forms: Use approved forms submitted with the Strategies and Procedures Plan.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the "AABC National Standards for Total System Balance."

#### 1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 T&B AGENCY

A. Subject to compliance with requirements, engage one of AABC certified T&B Agencies:

##### 3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

E. Examine equipment performance data including fan and pump curves.

F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.

G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor, and functioning.

- H. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
- I. Examine two-way valves for proper installation and function.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

### 3.3 PREPARATION

- A. Prepare a T&B plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:
  - 1. Airside:
    - a. Ductwork is complete with terminals installed.
    - b. Volume, smoke and fire dampers are open and functional.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Variable-frequency controllers' start-up is complete and safeties are verified.
    - f. Automatic temperature-control systems are operational.
    - g. Ceilings are installed.
    - h. Windows and doors are installed.
    - i. Suitable access to balancing devices and equipment is provided.
  - 2. Hydronics:
    - a. Piping is complete with terminals installed.
    - b. Water treatment is complete.
    - c. Systems are flushed, filled and air purged.
    - d. Strainers are pulled and cleaned.
    - e. Control valves are functioning per the sequence of operation.
    - f. Shutoff and balance valves have been verified to be 100 percent open.
    - g. Pumps are started and proper rotation is verified.
    - h. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
    - i. Variable-frequency controllers' start-up is complete and safeties are verified.
    - j. Suitable access to balancing devices and equipment is provided.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling-unit components.

### 3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report any artificial loading of filters at the time static pressures are measured.
  3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
  2. Adjust sub-main and branch duct volume dampers for specified airflow.  
Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure airflow at all inlets and outlets.
  3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after all have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
  2. Re-measure and confirm total airflow is within design.
  3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
  6. Measure and record all operating data.
  7. Record final fan-performance data.

### 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Verify that hydronic systems are ready for testing and balancing:
1. Check liquid level in expansion tank.
  2. Check that makeup water-has adequate pressure to highest vent.
  3. Check that control valves are in their proper position.
  4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
  5. Verify that motor starters are equipped with properly sized thermal protection.

6. Check that air has been purged from the system.

### 3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
  1. Measure total water flow.
    - a. Position valves for full flow through coils.
    - b. Measure flow by main flow meter, if installed.
    - c. If main flow meter is not installed determine flow by pump total dynamic head (TDH) or exchanger pressure drop.
  2. Measure pump TDH as follows:
    - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    - c. Convert pressure to head and correct for differences in gauge heights.
    - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - e. With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
  3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow measuring devices installed in mains and branches to design water flows.
  1. Measure flow in main and branch pipes.
  2. Adjust main and branch balance valves for design flow.
  3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow measuring devices installed at terminals for each space to design water flows.
  1. Measure flow at all terminals.
  2. Adjust each terminal to design flow.
  3. Re-measure each terminal after all have been adjusted.
  4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
  5. Perform temperature tests after all flows have been balanced.
- D. For systems with pressure-independent valves at the terminals:
  1. Measure differential pressure and verify that it is within manufacturer's specified range.
  2. Perform temperature tests after all flows have been verified.
- E. For systems without pressure-independent valves or flow measuring devices at the terminals:
  1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure all final pumps' operating data, TDH, volts, amps, static profile.
3. Mark all final settings.

G. Verify that all memory stops have been set.

### 3.9 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase/Hertz (Hz)
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test the manual bypass of the controller to prove proper operation.

### 3.10 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, fan-coil units, etc.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.



2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

### 3.11 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.12 FINAL TEST AND BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:
  - a. AABC certified company name
  - b. Company address
  - c. Company telephone number
  - d. Project identification number
  - e. Location
  - f. Project Architect
  - g. Project Engineer
  - h. Project Contractor
  - i. Project number
  - j. Date of report
  - k. AABC Certification Statement
  - l. Name, signature, and certification number of AABC TBE
2. Table of Contents.
3. AABC National Performance Guaranty.
4. Report Summary:

- a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
- 5. Instrument List:
  - a. Type.
  - b. Manufacturer.
  - c. Model.
  - d. Serial Number.
  - e. Calibration Date.
- 6. T&B Data:
  - a. Provide test data for specific systems and equipment as required by the most recent edition of the "AABC National Standards."
- C. One copy of the final test and balance report shall be sent directly to the engineer of record. Provide five additional copies to the contractor.

### 3.13 VERIFICATION OF T&B REPORT

- A. Final Verification:
  - 1. After testing and balancing is complete and accurately documented in the final report, request that a final verification be made by Engineer.
  - 2. The T&B Agency shall conduct the verification in the presence of Engineer.
  - 3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
  - 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  - 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final verification, the testing and balancing shall be considered incomplete.

### 3.14 REVERIFICATION

- A. T&B Agency shall recheck all measurements and make adjustments as required to complete the balancing. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second verification.
- B. If the second verification also fails, Owner/Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.

### 3.15 ADDITIONAL TESTS

- A. Sound Testing

1. After the systems are balanced and the spaces are architecturally complete, read and record sound levels at 10 locations as designated by the Engineer of record.
2. Instrumentation:
  - a. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
  - b. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
  - c. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 HZ to 8000 HZ.
  - d. The accuracy of the sound-testing meter shall be  $\pm 1$  decibel.
3. Test Procedures
  - a. Perform test at the quietest background noise period. Note any cause of unpreventable sound that may affect the test outcome.
  - b. Equipment should be operating at design values.
  - c. Calibrate the sound-testing meter prior to taking measurements.
  - d. Use a microphone suitable for the type of noise levels measured that is compatible with the meter. Provide a windshield for outside or in-duct measurements.
  - e. Record a set of background measurements in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment off.
  - f. Take sound readings in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment on.
  - g. Take readings no closer than 3' from a wall or from the operating equipment, and approximately 5' from the floor, with the meter held or mounted on a tripod.
  - h. For outdoor measurements, move the sound-testing meter slowly and scan the area that has the greatest exposure to the noise source being tested. (This type of reading is generally performed using the A-Weighted scale).
4. Reporting
  - a. The report must record: the location, the system tested, the dB(A) reading, and the sound pressure level in each octave band with equipment on and off.
  - b. Plot all the sound pressure levels on the NC work sheet, with the equipment on and off.

B. Vibration Testing:

1. After the systems are balanced and the spaces are architecturally complete, read and record vibration levels on all equipment with motor horsepower equal to or greater than 10 hp.
2. Instrumentation:
  - a. The vibration meter should be portable, battery-operated, and microprocessor-controlled, with or without a built-in printer.
  - b. The meter shall automatically identify engineering units, filter bandwidth, amplitude and frequency scale values.
  - c. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.

3. Test Procedures:

- a. Verify that the vibration meter calibration date is current before taking readings.
- b. To ensure accurate readings, verify that the accelerometer has a clean, flat surface and is mounted properly.
- c. With the unit running, set up the vibration meter in a safe, secure location. Connect the transducer to the meter with the proper cables. Hold the magnetic tip of the transducer on top of the bearing, and measure the unit in mils of deflection. Record the measurement, then move the transducer to the side of the bearing, and record in mils of deflection. Record an axial reading in mils of deflection by holding the nonmagnetic, pointed transducer tip on the end of the shaft.
- d. Change the vibration meter to velocity (inches per second) measurements. Repeat and record the above measurements.
- e. Record the CPM or the RPM.
- f. Read each bearing on the motor, fan, and/or pump as required. Track and record vibration levels from the rotating component through the casing to the base.

4. Reporting

- a. The report must record the location and the system tested.
- b. Include horizontal-vertical-axial measurements for all tests.
- c. Verify that vibration limits follow specifications, or, if not specified, follow the "General Machinery Vibration Severity Chart" or "Vibration Acceleration General Severity Chart" from the AABC National Standards. Acceptable levels of vibration are normally "Smooth" to "Good."
- d. Include in the report the Machinery Vibration Severity Chart, with conditions plotted.

C. Duct Leakage Testing:

1. Witness the duct pressure testing performed by the mechanical/installing contractor.
2. Verify that proper test methods are used and that leakage rates are within specified tolerances.
3. Report any deficiencies observed.

D. Controls Verification

1. In conjunction with system balancing perform the following:
  - a. Work with the temperature control contractor to ensure the system is operating within the design limitations, and gain a mutual understanding of intended control performance.
  - b. Confirm that the sequences of operation are in compliance with the approved drawings.
  - c. Verify that controllers are calibrated and function as intended.
  - d. Verify that controller setpoints are as specified.
  - e. Verify the operation of lockout or interlock systems.
  - f. Verify the operation of all valve and damper actuators.
  - g. Verify that all controlled devices are properly installed and connected to the correct controller.
  - h. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
  - i. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidities, or pressures.

2. Reporting

- a. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

END OF SECTION 230593



## SECTION 230713 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply, return & exhaust air.
  - 2. Indoor, concealed ductwork located in unconditioned space.
- B. Related Sections:
  - 1. Section 230719 "Piping Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.



- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, factory-applied FSK jacket/FSP jacket]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  - 2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 4. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  4. Color: White.

## 2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  4. Color: Aluminum.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  4. Color: White.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Width: 3 inches (75 mm).
  2. Thickness: 11.5 mils (0.29 mm).
  3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Width: 3 inches (75 mm).
  2. Thickness: 6.5 mils (0.16 mm).
  3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  1. Width: 2 inches (50 mm).
  2. Thickness: 6 mils (0.15 mm).
  3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  1. Width: 2 inches (50 mm).
  2. Thickness: 3.7 mils (0.093 mm).
  3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
  4. Elongation: 5 percent.
  5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

## 2.8 SECUREMENTS

- A. Bands:
  1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316]; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.
2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
  - b. Spindle: Copper- or zinc-coated, low-carbon steel/Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel/aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
  - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) soft-annealed, galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

- a. For below ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
  - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
  5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.7 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in nonconditioned space.
  - 4. Indoor, exposed return located in nonconditioned space.
  - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
  - 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
- B. Items Not Insulated:
  - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  - 2. Factory-insulated flexible ducts.
  - 3. Factory-insulated plenums and casings.
  - 4. Flexible connectors.
  - 5. Vibration-control devices.
  - 6. Factory-insulated access panels and doors.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply-air, return-air, exhaust-air and outdoor-air duct insulation shall be the following:
  - 1. Mineral Fiber Blanket: Minimum R-6, 2 inches thick, and minimum 1 lb. density.
- B. Exposed, supply-air, return-air, exhaust-air and outdoor-air duct insulation shall be the following:



1. All Exterior ductwork shall be 2" thick, 8lbs. density acoustic lining min. R-8.7 with IAQ liner as well as external insulation (min. 1.5" thick and 8 Lb. density). Min. R-6.5 external insulation. For additional installation information, refer to construction drawings.

END OF SECTION 230713



## SECTION 230714 - ACOUSTIC DUCT INSULATION

### PART 1 – GENERAL

#### 1.01 SCOPE

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of fibrous glass duct liner in sheet metal ducts in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:
  - 1. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below, and internal air temperatures not exceeding 250°F.
- B. The finished duct system shall meet the requirements of NFPA 90A and 90B.
- C. Dimensions shown on the plans are finished inside dimensions.
- D. Fabrication and installation shall conform to manufacturer's recommendations and to the requirements of the latest edition of North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards, hereinafter referred to as NAIMA FGDLS, and/or Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standard, HVAC Duct Construction Standards – Metal and Flexible, hereinafter referred to as SMACNA HVAC DCS.

#### 1.02 REFERENCES

- A. Duct liner insulation materials shall meet the requirements of the following:
  - 1. American Society for Testing and Materials specifications:
    - a. ASTM C 1071, Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

#### 1.03 DELIVERY AND STORAGE OF MATERIALS

- A. Deliver all materials and/or fabricated, insulated duct sections and fittings to the job site and store in a safe, dry place.
- B. Use all means necessary at the job site to protect materials from dust, dirt, moisture and physical abuse before and during installation.

#### 1.04 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 – PRODUCTS

### 2.01 INSULATED DUCT SYSTEM

- A. All supply ducts, return ducts and related fittings shall be insulated with one of the following as designated on project plans and specifications:

1. Owens Corning QuietR® Textile Duct Liner, for service at internal air velocities not to exceed 6,000 fpm:

- a. Type 200, 1-1/2" thick.

The duct liner shall have a black pigmented coating on the airstream side to resist damage during installation and in service. Edges shall be factory coated with the same black pigmented coating to comply with SMACNA HVAC DCS.

2. Owens Corning QuietR® Rotary Duct Liner, for service at internal air velocities not to exceed 6,000 fpm (30.5 m/s):

- a. Type R-6, 1-1/2" (38mm) thick.

The duct liner shall have a black pigmented coating on the airstream side to resist damage during installation and in service. Edges shall be factory coated with the same black pigmented coating to comply with SMACNA HVAC DCS.

3. Owens Corning Quiet® Duct Liner Board, for service at internal air velocities not to exceed 6,000 fpm (30.5 m/s):

- a. 3.0 pcf (48 kg/m<sup>3</sup>) density, 1-1/2" thick.

The duct liner shall have a black pigmented mat on the airstream side to resist damage during installation and in service. Edges shall be factory coated with black pigmented coating to comply with SMACNA HVAC DCS requirements.

## PART 3 – EXECUTION

### 3.01 INSPECTION

- A. Verify that the duct liner product may be installed in accordance with project drawings, operating performance parameters and limitations, and NAIMA FGDLS or SMACNA HVAC DCS.

### 3.02 INSULATION OF STRAIGHT DUCT AND FITTINGS

- A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black pigmented or mat faced surface of the duct liner shall face the airstream.
- B. Duct liner shall be adhered to the sheet metal with 90% coverage of adhesive complying with requirements of ASTM C 916. All exposed leading edges and transverse joints shall be factory coated or coated with adhesive during fabrication.

- C. Duct liner shall be additionally secured with mechanical fasteners, either weld-secured or impact-driven, which shall compress the duct liner sufficiently to hold it firmly in place. Adhesive bonded pins are not permitted due to long-term adhesive aging characteristics.

Spacing of mechanical fasteners with respect to duct liner interior width shall be in accordance with SMACNA HVAC DCS. Maximum spacing for mechanical fasteners shall be as follows:

Velocity = 0 to 2,500 feet per minute (0 to 12.8 m/s):

From transverse end of liner 3" (75mm)

Across width of duct 12" (300mm) O.C.

From corners of duct 4" (100mm)

Along length of duct 18" (450mm) O.C.

Velocity = 2,501 to 5,000 feet per minute  
(12.8 to 25.4 m/s):

From transverse end of liner 3" (75mm)

Across width of duct 6" (150mm) O.C.

From corners of duct 4" (100mm)

Along length of duct 16" (400mm) O.C.

- D. QuietR® Duct Liner products shall be cut to assure overlapped and compressed longitudinal corner joints.
- E. Quiet R® Duct Liner board shall be cut to assure tight, over-lapped corner joints. The top pieces of liner board shall be supported at the edges by the side pieces.

### 3.03 INSPECTION

- A. Upon completion of installation of duct liner and before operation is to commence, visually inspect the system and verify that the duct liner insulation has been correctly installed.
- B. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.
- C. Check the duct system to ensure that there are no air leaks through joints.

### 3.04 SAFETY PRECAUTIONS

- A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.
- B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION 230714



## SECTION 230719 - PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Heating hot-water piping.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

# PART 2 - PRODUCTS

## 2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
  - 1. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Block Insulation: ASTM C 552, Type I.
  - 2. Special-Shaped Insulation: ASTM C 552, Type III.
  - 3. Board Insulation: ASTM C 552, Type IV.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.



- D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied FSK jacket/FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- E. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- F. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
- G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ/FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  3. Solids Content: 60 percent by volume and 66 percent by weight.
  4. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  - 3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  - 4. Color: White.

## 2.5 SEALANTS

- A. Joint Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Permanently flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
  - 4. Color: White or gray.
  - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  - 4. Color: Aluminum.
  - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  - 4. Color: White.
  - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
  2. Color: Color-code jackets based on system.
  3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/2.5-mil- (0.063-mm-) thick polysurlyn.
    - b. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 3) Tee covers.
      - 4) Flange and union covers.
      - 5) End caps.
      - 6) Beveled collars.
      - 7) Valve covers.
      - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Width: 3 inches (75 mm).
  - 2. Thickness: 11.5 mils (0.29 mm).
  - 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Width: 3 inches (75 mm).
  - 2. Thickness: 6.5 mils (0.16 mm).
  - 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Width: 2 inches (50 mm).
  - 2. Thickness: 6 mils (0.15 mm).
  - 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  - 4. Elongation: 500 percent.
  - 5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Width: 2 inches (50 mm).
  - 2. Thickness: 3.7 mils (0.093 mm).
  - 3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
  - 4. Elongation: 5 percent.
  - 5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

## 2.9 SECUREMENTS

- A. Bands:
  - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with [wing seal] [or] [closed seal].
  - 2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy soft-annealed, galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping.
- C. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for



- above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Fire-suppression piping.
  2. Drainage piping located in crawl spaces.
  3. Below-grade piping.
  4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg. F and below:
  1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
  2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Mineral Fiber, Preformed Pipe, Type I: 2 inches thick.

### 3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230719

## SECTION 230923.11 – DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for complete building automation system (also identified as BMS, Direct Digital Control System For HVAC) including all necessary hardware and all operating and applications software as required for the complete performance of the Work, as shown on the Drawings, as specified herein.
- B. Related Sections: Related sections include, but shall not be limited to, the following:
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
  - 2. Applicable general requirements for electrical Work specified within Divisions 23 Specification Sections apply to this Section.
- C. Network level components of the system – workstations, servers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2004, EIA standard 709.1, the LonTalk™ protocol, or Modbus protocol. No gateways shall be used for communication to controllers furnished under this section.
- D. At a minimum, provide controls for the following:
  - 1. Roof Top Unit Integration
  - 2. Heat Recovery Unit Integration
  - 3. Unit Ventilators
  - 4. Split Heat Pump Units
  - 5. Connection to existing BMS
  - 6. Cabinet unit heater controls
  - 7. Exhaust Fans
  - 8. Finned tube radiation control
- E. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, Room Controllers, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.
- F. The BAS system supplier shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
- G. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS system supplier and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the

BAS system supplier shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

- H. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.
- I. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.
- J. Related Sections
  - 1. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. Depending on the scope of the project, the complete specification may have numerous sections that interface to this section, including several from Division 25, 26, & 28.

## 1.2 REFERENCES

- A. General, Code Compliance: The code listed below form a part of this Specification to the extent referenced. The codes are referred to in the text by the basic designation only. The edition/revision of the referenced code shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
  - 1. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.
  - 2. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
  - 3. All wiring shall conform to the National Electrical Code.
  - 4. All smoke dampers shall be rated in accordance with UL 555S.
  - 5. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
  - 6. Comply with FCC, Part 68 rules for telephone modems and data sets.

## 1.3 DEFINITIONS

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.
  - 1. Standard
    - a. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
    - b. AHU: Air Handling Unit
    - c. BACnet: Building Automation Controls Network
    - d. BMS: Building Management System
    - e. DDC: Direct Digital Control
    - f. EIA: Electronic Industries Alliance
    - g. GUI: Graphical User Interface
    - h. HVAC: Heating, Ventilation, and Air Conditioning
    - i. IEEE: Institute Electrical Electronic Engineers

- j. MER: Mechanical Equipment Room
- k. PID: Proportional, Integral, Derivative
- l. VAV: Variable Air Volume Box
- 2. Communications and protocols
  - a. ARP: Address Resolution Protocol
  - b. BACnet: Building Automation and Control Networks
  - c. CORBA: Common Object Request Broker Architecture
  - d. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
  - e. DDE: Dynamic Data Exchange
  - f. FTP: File Transfer Protocol
  - g. FTT: Free Topology Transceivers
  - h. HTTP: Hyper Text Transfer Protocol
  - i. IIOP: Internet Inter-ORB Protocol
  - j. IP: Internet Protocol
  - k. LAN: Local Area Network
  - l. LON: Echelon Communication – Local Operating Network
  - m. MS/TP: Master Slave Token Passing
  - n. OBIX: Open Building Information Exchange
  - o. ODBC: Open Database Connectivity
  - p. ORB: Object Request Broker
  - q. SNVT: Standard Network Variables Types
  - r. SQL: Structured Query Language
  - s. UDP: User Datagram Protocol
  - t. XML: eXtensible Markup Language
- 3. Controllers
  - a. ASD: Application Specific Device
  - b. AAC: Advanced Application Controller
  - c. ASC: Application Specific Controller.
  - d. CAC: Custom Application Controller.
  - e. DCU: Distributed Control Unit
  - f. LCM: Local Control Module
  - g. MC: MicroControllers
  - h. MPC: Multi-purpose Controller
  - i. NSC: Network Server Controller
  - j. PEM: Package Equipment Module
  - k. PPC: Programmable Process Controller
  - l. RC: Room controller
  - m. SDCU: Standalone Digital Control Units
  - n. SLC: Supervisory Logic Controller
  - o. UEC: Unitary Equipment Controller
  - p. VAVDDC: Variable Air Volume Direct Digital Controller
- 4. Tools and Software
  - a. AFDD: Automated Fault Detection and Diagnostic
  - b. APEO: Automated Predictive Energy Optimization

- c. DR: Demand Response
- d. CCDT: Configuration, Commissioning and Diagnostic Tool
- e. BPES: BACnet Portable Engineering Station
- f. LPES: LON Portable Engineering Station
- g. POT: Portable Operator's Terminal
- h. PEMS: Power and Energy Management Software
- i. MTBF: Mean Time Between Failure

#### 1.4 SYSTEM DESCRIPTION

- A. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability and allowing future expansion of both input/output points and processing/control functions.
- B. For this project, the system shall consist of the following components:
  - 1. Administration and Programming Workstation(s): The BAS system supplier shall include Operation software and architecture as described in Part 2 of the specification. These workstations must be running the standard workstation software developed and tested by the manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable. Workstations must conform to the B-OWS BACnet device profile.
  - 2. Web-Based Operator Workstations: The BAS system supplier shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.
  - 3. Ethernet-based Network Router and/or Network Server Controller(s): The BAS system supplier shall furnish needed quantity of Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet at a minimum of 100mbps and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network Server Controllers shall conform to BACnet device profile B-BC. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted. Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Building Controllers (B-BC).
  - 4. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment. Each BACnet protocol SDCU shall conform to the BACnet device profile B-AAC. BACnet SDCUs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Advanced Application Controllers (B-AAC).
- C. The Local Area Network (LAN) shall be either a 10 or 100 Mbps Ethernet network supporting BACnet, Modbus, XML and HTTP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.



- D. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.
- E. The system shall enable an open architecture that utilizes EIA standard 709.1, the LonTalk™ protocol and/or ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. Native support for the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol are required to assure that the project is fully supported by the HVAC open protocols to reduce future building maintenance, upgrade, and expansion costs.
- F. The system shall enable an architecture that utilizes a MS/TP selectable 9.6-76.8 Kbaud protocol, as a common communication protocol between controllers and integral ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. The AAC shall be capable of communicating as a MS/TP device or as a BACnet IP device communicating at 10/100 Mbps on a TCP/IP trunk. The ANSI / ASHRAE™ Standard 135-2004, BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.
- G. LonTalk™ packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth where necessary or desired.
1. Any such encapsulation of the LonTalk™ protocol into IP datagrams shall conform to existing LonMark™ guide functionality lines for such encapsulation and shall be based on industry standard protocols.
  2. The products used in constructing the BMS shall be LonMark™ compliant.
  3. In those instances in which Lon-Mark™ devices are not available, the BMS system supplier shall provide device resource files and external interface definitions for LonMark devices.
- H. The software tools required for network management of the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. BACnet clients shall comply with the BACnet Operator Workstation (B-OWS) device profile; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP. Physical connection of LonWorks devices shall be via Ethernet IP or FTT-10A.
- I. The system shall provide support for Modbus TCP and RTU protocols natively, and not require the use of gateways.
- J. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
1. The supplied system must incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs. The system shall not require JAVA to be enabled in the browser.
  2. Data shall reside on a supplier-installed server for all database access.

3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.
- K. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 3 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 100 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.
- L. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC), Unitary Equipment Controllers (UEC) and VAV controllers (VAVDDC), monitoring all BACnet objects, monitoring overrides of all controller physical input/output points, and editing of controller resident time schedules.

#### 1.5 SUBMITTALS

- A. General: Submittals shall be in accordance with the requirements of Section [01 33 00][01300] Submittals and Section 23 00 10 Mechanical, in addition to those specified herein.
  1. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.
  2. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typicals will be allowed where appropriate.
  3. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
  4. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs. Diagrams shall be on 11" by 17" foldouts. If color has been used to differentiate information, the printed copies shall be in color.
  5. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.
  6. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.
  7. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as "As-Built".

- a. System architecture drawing.
  - b. Layout drawing for each control panel
  - c. Wiring diagram for individual components
  - d. System flow diagram for each controlled system
  - e. Instrumentation list for each controlled system
  - f. Sequence of control
  - g. Binding map
  - h. A matrix sheet detailing all system addresses and communication settings for the following:
    - 1) All IP network addresses & settings
    - 2) All BMS device addresses & communication settings
  - i. Operation and Maintenance Manuals
8. Information common to the entire system shall be provided. This shall include but not be limited to the following.
- a. Product manuals for the key software tasks.
  - b. Operating the system.
  - c. Adminstrating the system.
  - d. Engineering the operator workstation.
  - e. Application programming.
  - f. Engineering the network.
  - g. Setting up the web server.
  - h. Report creation.
  - i. Graphics creation.
  - j. All other engineering tasks.
  - k. System Architecture Diagram.
  - l. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
  - m. Define the task.
  - n. Recommend a frequency for the task.
  - o. Reference the product manual that includes instructions on executing the task.
  - p. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
  - q. Licenses, guarantees, and warranty documents for equipment and systems.
  - r. Submit one copy for each building, plus two extra copies.
9. Information common to the systems in a single building shall be provided.
- a. System architecture diagram for components within the building annotated with specific location information.
  - b. As-built drawing for each control panel.
  - c. As-built wiring design diagram for all components.
  - d. Installation design details for each I/O device.
  - e. As-built system flow diagram for each system.
  - f. Sequence of control for each system.
  - g. Binding map for the building.
  - h. Product data sheet for each component.
  - i. Installation data sheet for each component.

- j. Submit two copies for each building and two extra copies.
- 10. Software shall be provided:
  - a. Submit a copy of all software installed on the servers and workstations.
  - b. Submit all licensing information for all software installed on the servers and workstations.
  - c. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
  - d. Submit all licensing information for all of the software used to execute the project.
  - e. All software revisions shall be as installed at the time of the system acceptance.
  - f. Firmware Files
  - g. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
  - h. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
  - i. Submit a copy of all application files that were created during the execution of the project.
  - j. Submit a copy of all graphic page files created during the execution of the project.

## 1.6 QUALITY ASSURANCE

- A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 3 years.
  - 1. The Building Management System contractor shall have a full service facility within 100 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.
  - 2. Any installing contractor, not listed as prequalified in the Approved Manufacturer's section, shall submit credentials as detailed in the Pre-bid Submittal section for the engineer's review 2 weeks prior to bid date. Failure to follow the attached formats shall disqualify potential alternate bidders. Credentials must attest that the contractor meets all requirements of the specification and the Engineers judgment regarding approval to bid as an acceptable installer after reviewing the data will be final.
- B. All bidders must be authorized distributors or branch offices of the manufacturers specified.
- C. The following bidders have been pre-qualified:
  - 1. Schneider Electric
  - 2. Or as approved by Engineer.
- D. Any installing contractors or manufacturers interested in participating as acceptable bidders for this project that are not pre-qualified shall furnish a detailed technical pre-bid submittal to the consulting engineer. All information must be submitted 2 weeks prior to the published bid date to allow the engineer adequate time to review the bidder's credentials.
- E. The Pre-Bid submittal shall contain the following information as a minimum:
  - 1. A profile of the manufacturer and the local installation and service/organization.
  - 2. Description of how the system meets and achieves all the specified criteria in terms of configuration, operation, and control.

3. System Architecture with single line riser diagram showing all major components (digital controllers, routers, hubs, etc.) that will be required for this project.
  4. Procedure for commissioning and time required to startup and commission each of the systems for this project.
  5. Contractors approach for the project planning and management.
  6. Product Data Sheets for all components, DDC panels, and all accessories listed per the appropriate specification sections herein.
  7. Examples of actual graphic screens for other similar projects.
  8. Number and types of DDC panels required for this installation.
  9. Number and types of spare points provided with the proposed system.
  10. Recommended spare parts list for components with list price schedule.
  11. List of 2 similar systems in size, point capacity, total installed value, installed and commissioned by the local office with a list of the installers/manufacturers design team members for each project and the owners contact information.
  12. Samples of service offerings and a list of current similar service contracts with contact information.
  13. Resumes for the management team and all employees who will be involved with the project design, commissioning, project management, and after installation service. Resumes should include copies of manufacturer's certifications for the proposed product line.
  14. Copy of this Control Specification in its entirety with a check mark beside each paragraph to signify that the manufacturer's equipment and software shall fully conform to the specified requirement. If the requirement cannot be met, indicate the reasons/limitations and the alternative proposed.
  15. An interview may be conducted, and the bidder will be requested to make a formal presentation concerning the proposed system and possibly provide an installed project tour prior to a final decision.
- F. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.
- G. The BAS system supplier shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.
- H. The BAS system supplier shall provide a technician for 5 days manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS system supplier shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.
- I. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.
- J. Required elements of the startup testing include:

1. Measurement of voltage sources, primary and secondary
  2. Verification of proper controller power wiring.
  3. Verification of component inventory when compared to the submittals.
  4. Verification of labeling on components and wiring.
  5. Verification of connection integrity and quality (loose strands and tight connections).
  6. Verification of bus topology, grounding of shields and installation of termination devices.
  7. Verification of point checkout.
  8. Each I/O device is landed per the submittals and functions per the sequence of control.
  9. Analog sensors are properly scaled and a value is reported
  10. Binary sensors have the correct normal position and the state is correctly reported.
  11. Analog outputs have the correct normal position and move full stroke when so commanded.
  12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
  13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
  14. Documentation of Loop tuning (sample rate, gain and integral time constant).
- K. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
1. Graphics navigation.
  2. Trend data collection and presentation.
  3. Alarm handling, acknowledgement and routing.
  4. Time schedule editing.
  5. Application parameter adjustment.
  6. Manual control.
  7. Report execution.
  8. Automatic backups.
  9. Web Client access.
- L. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

## 1.7 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panel boards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.
- C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.
- D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

- E. Coordinate with the Owner's IT department on locations for NSC's, Ethernet communication cabling and TCP/IP addresses.

## 1.8 OWNERSHIP

- A. The Owner shall retain licenses to software for this project.
- B. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition off this contractor. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer's license agreement but shall protect the manufacturer's rights to disclosure of Trade Secrets contained within such software.
- C. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner's computers and only for the purpose of commissioning, servicing, or altering the installed system.
- D. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:
  - 1. Server and workstation software
  - 2. Application programming tools
  - 3. Configuration tools
  - 4. Network diagnostic tools
  - 5. Addressing tools
  - 6. Application files
  - 7. Configuration files
  - 8. Graphic files
  - 9. Report files
  - 10. Graphic symbol libraries
  - 11. All documentation

## 1.9 WORK BY OTHERS

- A. The BAS system supplier shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.
- B. The BAS system supplier shall furnish all Control Valves, Flow Meters, Sensor Wells and other similar equipment for installation by the Mechanical Contractor and/or others.
- C. The BAS system supplier shall provide field supervision to the designated contractor for the installation of the following:
  - 1. Automatic control dampers
  - 2. Blank-off plates for dampers that are smaller than duct size.
  - 3. Sheet metal baffles plates to eliminate stratification.
  - 4. The Electrical Contractor shall provide:
    - a. All 120VAC power wiring to motors, heat trace, junction boxes for power to BAS panels.

- b. Furnish smoke detectors and wire to the building fire alarm system. HVAC Contractor to mount devices. BAS system supplier to hardwire to fan shut down.
  - c. Auxiliary contact (pulse initiator) on the electric meter for central monitoring of kWh and KW. Electrical Contractor shall provide the pulse rate for remote readout to the BAS. BAS system supplier to coordinate this with the electrical contractor.
- D. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.
- E. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- F. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

#### 1.10 WARRANTY

- A. All components, system software, and parts furnished and installed by the BMS system supplier shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS system supplier at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS system supplier shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:
  - 1. Direct Digital Control Systems Field Controller Devices:
    - a. Schneider Electric EcoStruxure Building MPX BACnet series, b3 BACnet series, MNB BACnet, MNL LON, Xenta LON series installed by approved manufacturer's local field office or authorized distributor.
    - b. Or Engineer approved equal.

### 2.2 SYSTEM ARCHITECTURE

- A. A. General
  - 1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs).



- The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
2. An Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming, and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks.
  3. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.
  4. For Enterprise reporting capability and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be installed on a Microsoft Windows SQL based computer. The Reports Server can be installed on the same computer as the Enterprise Server.
  5. The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP, LonWorks IP, and/or Modbus TCP protocol.
- B. Modbus RTU/ASCII (and J-bus), Modbus TCP, BACnet MS/TP, BACnet IP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported.
- C. A sub-network of SDCUs using the BACnet IP, BACnet MS/TP, LonTalk FTT-10A, and/or Modbus RTU protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.
- D. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.
- E. The fieldbus layer shall support all of the following types of SDCUs:
1. BACnet IP SDCU requirements: The system shall consist of one or more BACnet/IP field buses managed by the Network Server Controller. The field bus layer shall consist of up to 50 IP SDCUs in daisy chain topology, or 39 if using RSTP, per layer, with a max of 5 sub networks in daisy chain for a total of 250 SDCUs or 6 sub networks in RSTP for a total of 234 SDCUs.
  2. BACnet MS/TP SDCU requirements: The system shall consist of one or more BACnet MS/TP field buses managed by the Network Server Controller. Minimum speed shall be 76.8kbps. The field bus layer consists of an RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC and lighting equipment. These devices shall conform to BACnet standard 135-2004. The NSCs shall be capable of at least two BACnet MS/TP field buses for a total capability of 254 SDCUs per NSC.
- F. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN). Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.
- G. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

#### H. System Expansion

1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
2. Web-based operation shall be supported directly by the NSCs and require no additional software.
3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

- I. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

### 2.3 OPERATOR WORKSTATION REQUIREMENTS

#### A. General

1. The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations, and one or more web-based operator workstations. For this project provide a minimum of 10 concurrent operator users and/or 2 concurrent engineering users within the enterprise server.
2. The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC and/or Enterprise Server database.
3. Web-based workstations shall have a minimum of 10 concurrent operator users.
4. All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.
5. A minimum of 1 physical Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

#### B. Administration/Programming Workstation

1. The workstation shall consist of the following:
  - a. Processor: Minimum: 2.0 GHz
  - b. Memory: Minimum: 4GB
  - c. Operating systems: Microsoft Windows 10 64-bit (Pro or Enterprise)
  - d. Serial port, parallel port, USB port
  - e. 10/100MBPS Ethernet NIC
  - f. 20 GB hard disk
  - g. DVD drive
  - h. High resolution (minimum 1280 x 1024), 17" flat panel display
  - i. Optical mouse and full function keyboard
  - j. Audio sound card and speakers
  - k. Required additional software: Microsoft .Net 4.5
  - l. License agreement for all applicable software.

#### C. Web-Based Operator PC Requirements

1. Any user on the network can access the system, using the following software:
  - a. Internet Explorer 11
  - b. Mozilla Firefox
  - c. Google Chrome

D. General Administration and Programming Workstation Software

1. System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.
2. The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
3. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

E. User Interface:

1. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of "hot-spots" that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user's "PC Desktop" – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shut down the active alarm viewer and/or unable to load software onto the PC.
2. System shall be able to automatically switch between displayed metric vs. imperial units based on the web-station localization.
3. The BMS web-station shall be capable of multiple language display, including English, Spanish, German, French, Japanese, Italian, Finnish, Portuguese, Swedish, Russian, and traditional and simplified Chinese. The multiple languages shall not require additional add on software from the standard workstation installer and shall be selectable within said workstation.
4. Web-stations shall have the capability to automatically re-direct to an HTTPS connection to ensure more secure communications.
5. Personalized layouts and panels within workstations shall be extended to web-stations to ensure consistent user experiences between the two user interfaces.
6. Servers and clients shall have the ability to be located in different time zones, which are then synchronized via the NTP server.
7. Workstation shall indicate at all times the communication status between it and the server.

F. User Security

1. The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set

of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 256 users to be configured per workstation. Additionally, the software shall enable the ability to add/remove users based upon Microsoft Windows Security Domains that enable the customer IT department to assist in user access.

2. Additional requirements include mandatory change of passwords:
  - a. At first logon with default credentials
  - b. Of admin passwords before deploying
3. No general accounts, one account per user
4. Capability to integrate and use Windows Active Directory for user log on credentials
5. Include a timed auto log off feature
6. Use TLS 1.2 encryption or higher
7. Capability to use blacklisted and whitelisted IPs/MAC addresses to gate access
8. All devices and software that support HTTP shall allow disabling the HTTP access and require access via HTTPS.
9. All devices that have web portals for the configuration of IP addresses and other configuration attributes shall have the ability, through commands issued, to disable this service upon completion. A direct connection method with ASCII commands shall enable this service again if changes need to be applied. Loss of power or cycling the device shall not reverse this command. Disabling this web portal eliminates the security risk and the need for updating security patches.
10. All devices shall support SNMP V3 monitoring of network performance and stack statistics for the purpose of managing denial of service attacks
11. The Integrated Control Platform shall support the feature to alarm on a predetermined period of time until the default password for each device is changed from the default factory setting.
12. The Integrated Control Platform shall support encrypted password authentication for all web services whether serving or consuming.

#### G. Configuration Interface

1. The workstation software shall use a familiar Windows Explorer style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a "network map" of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.
2. The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created from the base object types within the system input, output, string variables, setpoints, etc., alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as a predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency. The system shall also maintain a link to all "child" objects created. If a user wishes to make a change to a parent object, the software shall ask the user if he/she wants to update all of the child objects with the change.

#### H. Color Graphic Displays

1. The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
2. Requirements of the color graphic subsystem include:
  - a. At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
  - b. The system shall support HTML5 enabled graphics.
  - c. It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
  - d. The editor shall use Scalable Vector Graphics (SVG) technology.
  - e. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, and graphs which can be “dropped” on a graphic through the use of a software configuration “wizard”. These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
  - f. Support for high DPI icons shall be included and automatically chosen if viewing on a high definition display such as Retina or 4K displays.
  - g. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
  - h. Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
  - i. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
  - j. It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
  - k. Graphics should rescale based on whatever monitor or viewing device is being used.
  - l. Be able to create graphics on varying layers that can be moved and repeated.
  - m. Be able to create graphics within varying window panes that can be moved and/or re-referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.
  - n. The ability to create re-usable cascading menus.
  - o. The ability to have multiple instances of a graphic and edit one instance to change all.
3. Additionally, the Graphics Editor portion of the Engineering Software shall provide the following capabilities:
  - a. Create and save pages.
  - b. Group and ungroup symbols.
  - c. Modify an existing symbol.
  - d. Modify an existing graphic page.
  - e. Rotate and mirror a symbol.
  - f. Place a symbol on a page.
  - g. Place analog dynamic data in decimal format on a page.

- h. Place binary dynamic data using state descriptors on a page.
  - i. Create motion through the use of animated .gif files or JavaScript.
  - j. Place test mode indication on a page.
  - k. Place manual mode indication on a page.
  - l. Place links using a fixed symbol or flyover on a page.
  - m. Links to other graphics.
  - n. Links to web sites.
  - o. Links to notes.
  - p. Links to time schedules.
  - q. Links to any .exe file on the operator work station.
  - r. Links to .doc files.
  - s. Assign a background color.
  - t. Assign a foreground color.
  - u. Place alarm indicators on a page.
  - v. Change symbol/text/value color as a function of an analog variable.
  - w. Change a symbol/text/value color as a function of a binary state.
  - x. Change symbol/text/value as a function of a binary state.
  - y. All symbols used by Schneider Electric EcoBuilding Business in the creation of graphic pages shall be saved to a library file for use by the owner.
- I. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.
- J. Alarm Management
- 1. The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
  - 2. Alarm management features shall include:
    - a. A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels. At the Enterprise level the minimum number of active and viewable alarms shall be 10,000. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
    - b. Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
    - c. Playing an audible sound on alarm initiation or return to normal.
    - d. Sending an email page to anyone specifically listed on the initial occurrence of an alarm. The ability to utilize email paging of alarms shall be a standard feature of the software using Simple Mail Transfer Protocol (SMTP) with support for secure email using Simple Mail Transfer Protocol Secure (SMTPS) No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
    - e. Individual alarms shall be able to be re-routed to a user at user-specified times and dates. For example, a critical high temp alarm can be configured to be routed to a

Facilities Dept. workstation during normal working hours (7am-6pm, Mon-Fri) and to a Central Alarming workstation at all other times.

- f. An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.
- g. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
- h. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
- i. The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.
- j. The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to 'normal' and the quantity of disabled and hidden alarms.
- k. The alarm viewer can be configured to auto hide alarms when triggered.
- l. An operator shall have the capability to assign an alarm to another user of the system.
- m. Time schedules shall be able to be used to set control notifications to users.
- n. An operator shall have the capability to save and apply alarm favorites.
- o. Alarm notifications must support multiple distribution methods within one notification.

K. Report Generation

- 1. The Reports Server shall be able to process large amounts of data and produce meaningful reports to facilitate analysis and optimization of each installation.
- 2. Reports shall be possible to generate and view from the operator Workstation, and/or Webstation, and/or directly from a reports-only web interface.
- 3. A library of predefined automatically generated reports that prompt users for input prior to generation shall be available. The properties and configurations made to these reports shall be possible to save as Dashboard reports, so that the configurations are saved for future used.
- 4. It shall be possible to create reports standard tools, such as Microsoft Report Builder 2.0 or Visual Studio, shall be used for customized reports.
- 5. Additional reports or sets of reports shall be downloadable, transferrable, and importable
- 6. All reports shall be able to be set up to automatically run or be generated on demand.
- 7. Each report shall be capable of being automatically emailed to a recipient in Microsoft Word, Excel, and/or Adobe .pdf format.
- 8. Reports can be of any length and contain any point attributes from any controller on the network.
- 9. Image management functionality shall be possible to enable the system administrators to easily upload new logos or images to the system.
- 10. It shall be possible to run other executable programs whenever a report is initiated.
- 11. Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.
- 12. Minimum supplied reports shall include:
  - a. Activities Per Server Report
  - b. Activities Per User Report

- c. Alarm Amount by Category Report
- d. Alarm Amount by Type Report
- e. Alarms Per Sever Report
- f. Current Alarm Report
- g. Most Active Alarm Report
- h. System Errors Per Server Report
- i. Top Activities Report
- j. Top Alarms Report
- k. Top System Errors Report
- l. Trend Log Comparison Report
- m. User Logins Report
- n. Users and Groups Reports
- 13. Minimum Energy Reports shall include:
  - a. Energy Monitoring Calendar Consumption Report: Shall provide an interactive report that shows the energy usage on one or multiple selected days.
  - b. Energy Monitoring Consumption Breakdown Report: Shall provide a report on energy consumption broken down using sub-metering.
  - c. Energy Monitoring Consumption Report: Shall show the energy consumption against a specified target value.
- 14. Reports Server Hardware Requirements
  - a. Processor
    - 1) Minimum: 2.0 GHz
    - 2) Recommended: 2.0 GHz or higher
  - b. Memory
    - 1) Minimum: 6 GB
    - 2) Recommended: 8GB or higher
  - c. Hard Disk: 500 GB
- 15. Reports Server Software Requirements
  - a. Operating System: Microsoft Windows 10 64-bit (Pro or Enterprise)
  - b. SQL Versions: Microsoft SQL Server 2012 64-bit (with Advanced Services)
  - c. Additional required software: Microsoft .Net 4.5

L. Scheduling

- 1. From the workstation or web-station, it shall be possible to configure and download schedules for any of the controllers on the network.
- 2. Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.
- 3. Schedules shall be programmable for a minimum of one year in advance.
- 4. To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.
- 5. Additionally, from the operator web-stations, each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.
- 6. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.



7. It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.
8. It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.
9. It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.
10. It should accommodate a minimum of 16 priority levels.
11. Values should be able to be controlled directly from a schedule, without the need for special program logic.

M. Programmer's Environment

1. Programming in the NSC shall be either in graphical block format or line-programming format or both.
2. Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except, of course, the viewing of live tasks or values.
3. The programmer's environment will include access to a superset of the same programming language supported in the SDCUs.
4. NSC devices will support both script programming language as well as the graphical function block programming language. For both languages, the programmer will be able to configure application software for custom program development and write global control programs. Both languages will have debugging capabilities in their editors.
5. It shall be possible to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.
6. It shall be possible to view graphical programming live and real-time from the Workstation.
7. The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.
8. Key terms should appear when typing (IntelliType).
9. Applications should be able to be assigned different priorities and cycle times for a prioritized execution of different function.
10. The system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

N. Saving/Reloading

1. The workstation software shall have an application to save and restore NSC and field controller memory files.
2. For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.

O. Audit Trail

1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.

2. It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.
  3. The Enterprise server shall be able to store up to 5 million events.
  4. The event view shall support viewing of up to 100,000 events.
  5. It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.
  6. It shall be capable to search and view all forced values within the system.
- P. Fault Tolerant Enterprise Server Operation (Top level NSC)
1. A single component failure in the system shall not cause the entire system to fail. All system users shall be informed of any detectable component failure via an alarm event. System users shall not be logged off as a result of a system failure or switchover.
- Q. Web-based Operator Software
1. General:
    - a. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any part of the system from anywhere on the network.
    - b. The system shall be able to be accessed on site via a mobile device environment with, at a minimum, access to overwrite and view system values.
  2. Graphic Displays
    - a. The browser-based interface must share the same graphical displays as the Administration and Programming Workstations, presenting dynamic data on site layouts, floor plans, and equipment graphics. The browser's graphics shall support commands to change setpoints, enable/disable equipment and start/stop equipment.
    - b. Through the browser-based interface, operators must be able to navigate through the entire system, and change the value or status of any point in any controller. Changes are effective immediately to the controller, with a record of the change stored in the system database.
  3. Alarm Management
    - a. Systems requiring additional client software to be installed on a PC for viewing the webstation from that PC will not be considered.
    - b. Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation shall be presented, if the user's password allows it. Users must be able to receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text must be able to be added to the alarm record before acknowledgement, attachments shall be viewable, and alarm checklists shall be available.
- R. Groups and Schedules
1. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
  2. Through the browser interface, operators must be able to change schedules – change start and stop times, add new times to a schedule, and modify calendars.
- S. User Accounts and Audit Trail
1. The same user accounts shall be used for the browser interface and for the operator workstations. Operators must not be forced to memorize multiple passwords.

2. All commands and user activity through the browser interface shall be recorded in the system's activity log, which can be later searched and retrieved by user, date, or both.

T. Web Services

1. The installed system shall be able to use web services to "consume" information within the Network Server/Controllers (NSCs) with other products and systems. Inability to perform web services within the NSCs will be unacceptable.
  - a. Shall be able to "consume" data into the system via SOAP and REST web services

2.4 NETWORK SERVER CONTROLLERS (NSC)

- A. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.
- B. The BACnet NSC shall be classified as a "native" BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Network Server Controllers (B-BC).
- C. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices and provide global supervisory control functions over the control devices connected to the NRS.
- D. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.
- E. Whitelisting of file extensions for documents shall be capable.
- F. Encrypted and authenticated communication shall be configurable for non-open protocol communications using TLS 1.2.
- G. The NSCs shall support Simple Network Management Protocol version 3 (SNMPv3) for monitoring of the NSCs using a Network Management Tool.
- H. The NSCs shall support remote system logging for used by System Information and Event Monitoring (SIEM) software.
- I. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.
- J. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.
- K. It shall be capable of executing application control programs to provide:
  1. Calendar functions
  2. Scheduling
  3. Trending
  4. Alarm monitoring and routing
  5. Time synchronization by means of an Internet site including automatic synchronization
  6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data

7. Network Management functions for all LonWorks based devices

L. Hardware Specifications

1. Memory: The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
2. Each NRC shall provide the following on-board hardware for communication:
  - a. Two 10/100b Ethernet for communication to Workstations, other NRCs, IP field bus controllers, other SDCUs, and onto the internet.
    - 1) The two Ethernet ports shall support active switch and BACnet/IP communication protocols.
    - 2) Support IPv4 addressing
    - 3) Ethernet port 1 shall support static or DHCP client configuration for communication to Workstation or other NSCs
    - 4) Ethernet port 2 shall support switch mode or DHCP server to set addressing of DHCP client devices
    - 5) It shall be possible to disable Ethernet port 2
    - 6) In DHCP server mode, the Ethernet port 2 shall support 50 BACnet/IP field controllers in daisy chain configuration directly from the port
    - 7) Each NSC shall be able to support a total of 250 IP SDCUs in daisy chain configuration (5 sub networks via switch)
    - 8) If using RSTP (Rapid Spanning Tree Protocol) with a managed switch (with IEEE 802.1W or IEEE 802.1Q-2014 support), Ethernet port 2 shall support up to 39 devices
    - 9) Each NSC shall be able to support a total of 234 IP SDCUs in RSTP configuration (6 sub networks via managed switch)
    - 10) Where a switch is needed, use an EtherWAN EX63402-01B, or other equal and approved equivalent.
  - b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
  - c. One TP/FT port for communication to LonWorks devices.
  - d. One device USB port
  - e. One host USB port
3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).

M. Modular Expandability:

1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
2. One shall be able to "hot-change" (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.
3. If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.

N. Hardware Override Switches:

1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be

equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

O. Universal Input Temperatures

1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
  - a. 10 kohm Type I (Continuum)
  - b. 10 kohm Type II (I/NET)
  - c. 10 kohm Type III (Satchwell)
  - d. 10 kohm Type IV (FD)
  - e. Linearized 10 kohm Type V (FD w/11k shunt)
  - f. Linearized 10 kohm (Satchwell)
  - g. 1.8 kohm (Xenta)
  - h. 1 kohm (Balco)
  - i. 20 kohm (Honeywell)
  - j. 2.2 kohm (Johnson)
2. In addition to the above, the system shall be capable of using the below RTD sensors, however it is not required that all universal inputs be compatible with them.
  - a. PT100 (Siemens)
  - b. PT1000 (Sauter)
  - c. Ni1000 (Danfoss)

P. Local Status Indicator Lamps:

1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.

Q. Real Time Clock (RTC):

1. Each NSC shall include a real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.
2. The RTC date and time shall also be accurate, up to 30 days, when the NSC is powerless.
3. No batteries may be used to for the backup of the RTC.

R. Power Supply:

1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.

S. Automatic Restart After Power Failure:

1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.
- T. Data Retention:
1. During a power failure, the NSC shall retain all programs, configuration data, historical data, and all other data that is configured to be retained. There shall be no time restriction for this retention and it must not use batteries to achieve it.
- U. Software Specifications
1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
  2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.
- V. User Programming Language:
1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.
  2. Network Server Controllers that use a “canned” program method will not be accepted.
- W. Control Software:
1. The NSC shall have the ability to perform the following pre-tested control algorithms:
    - a. Proportional, Integral plus Derivative Control (PID)
    - b. Two Position Control
    - c. Digital Filter
    - d. Ratio Calculator
    - e. Equipment Cycling Protection
- X. Mathematical Functions:
1. Each controller shall be capable of performing basic mathematical functions (+, -, \*, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.
- Y. NSCs shall have the ability to perform any or all of the following energy management routines:
1. Time of Day Scheduling
  2. Calendar Based Scheduling
  3. Holiday Scheduling

4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Night Setback Control
8. Enthalpy Switchover (Economizer)
9. Peak Demand Limiting
10. Temperature Compensated Duty Cycling
11. CFM Tracking
12. Heating/Cooling Interlock
13. Hot/Cold Deck Reset
14. Hot Water Reset
15. Chilled Water Reset
16. Condenser Water Reset
17. Chiller Sequencing

Z. History Logging:

1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.
5. The presentation of logged data shall be built into the server capabilities of the NSC. Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.
6. Tooltips shall be present, magnetic, and visible based on users preference.
7. Comments shall be visible whenever viewing the trend log list.
8. System shall give indication of memory usage and be able to alert the user if too many logs are allocated.

AA. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc.

These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.

5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.
6. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

BB. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.
2. The NSC shall be configurable to logging all Embedded Web Server access attempts
3. The NSC shall have the option to redirect HTTP based Embedded Web Server connections to secure, HTTPS connections.
4. The NSC shall authenticate and authorize all users connecting to the Embedded Web Server
5. The NSC shall provide to ability to configure an automatic logoff for Embedded Web Server users that have not had any activity for an adjustable time period.

2.5 BACNET IP FIELDBUS CONTROLLERS

A. Controllers – BACnet/IP Protocol

1. All BACnet/IP Fieldbus controllers shall be BACnet Testing Laboratory listed (v12 or later) as specified BACnet Advanced Application Controller (B-AAC)
2. All BACnet/IP Fieldbus controllers shall use the following communication specifications and achieve performance as specified herein:
  - a. All controllers shall be able to communicate peer-to-peer without the need for a NSC
  - b. Any BACnet/IP Fieldbus controllers on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.

B. The BACnet/IP Fieldbus controllers shall be equipped with 2x 10/100bT Ethernet communication ports with active switch and will support BACnet/IP communication protocols with the following configurations:

1. Supporting IPv4 addressing
2. Supporting Static IP setting, DHCP client and Auto-IP address acquisition
3. It shall be possible to disable Ethernet port 2

C. Topologies

1. BACnet/IP Fieldbus controllers shall support daisy chain topology of up to 50 controllers. In case of any disruption to the communication, a system alarm shall notify the NSC/BMS of the point disruption has occurred.
2. BACnet/IP Fieldbus Controllers shall support RSTP loop whereby up to 39 controllers are supported.
  - a. In case of any disruption there shall be no communication interruption



- b. In case of any disruption there shall be system alarms that will inform the operator of the disruption

D. Performance

1. Each BACnet/IP Fieldbus Controllers shall have a 32-bit microprocessor operating at 500 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2008 and the BACnet Device Profile supported.
2. They shall be multi-tasking, real-time digital control processors consisting of communication controllers, controls processing, power supplies with built-in inputs and outputs.

E. Programmability

1. The BACnet/IP Fieldbus controllers shall support both script programming language and graphical that will be consistent with the NSC.
2. The control program will reside within the same enclosure as the input/output circuitry, that reads inputs and controls outputs
3. All control sequences programmed into the BACnet/IP Fieldbus Controllers shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
4. BACnet/IP Fieldbus controllers shall communicate with the Network Server Controller (NSC) via a BACnet/IP connection at a baud rate of not less than 100 Mbps
5. BACnet/IP Fieldbus controllers shall support a dedicated communications port for connecting and supplying power to a matching room temperature and/or humidity sensor and/or CO2 and/or presence detector that does not utilize any of the I/O points of the controller.
6. BACnet/IP Fieldbus controllers (Excluding VAV) shall support an add-on display to supply and provide access in real-time for monitoring inputs and overriding of outputs
7. The override functionality must be supported by a dedicated processor to assure reliable operation (overriding of output)
8. Each BACnet/IP Fieldbus controller shall have sufficient memory, to support its own operating system and databases, including:
  - a. Control processes
  - b. Energy management applications
  - c. Alarm management
  - d. Historical/trend data
  - e. Maintenance support applications
  - f. Custom processes
  - g. Manual override monitoring
9. Each BACnet/IP Fieldbus controller shall support local trend data up to 2x the built-in I/O and at a minimum be capable of holding 5 days @ 15 min intervals locally.
10. The BACnet/IP Fieldbus controller analog or universal input shall use a 16 bit A/D converter.
11. The BACnet/IP Fieldbus controller analog or universal output shall use a 10 bit D/A converter.
12. Built-in I/O: each BACnet/IP Fieldbus controllers shall support:
  - a. At minimum 8 and up to 20 configurable IO channels to monitor and to control the following types of inputs and outputs without the addition of equipment inside or outside the DDC Controller cabinet.
    - 1) Universal Inputs – the following thermistors for use in the system without any external converters needed.

- a) 10 kohm Type I (Continuum)
    - b) 10 kohm Type II (I/NET)
    - c) 10 kohm Type III (Satchwell)
    - d) 10 kohm Type IV (FD)
    - e) Linearized 10 kohm Type V (FD w/11k shunt)
    - f) Linearized 10 kohm (Satchwell)
    - g) 1.8 kohm (Xenta)
    - h) 1 kohm (Balco)
    - i) 20 kohm (Honeywell)
    - j) 2.2 kohm (Johnson)
    - k) PT100 (Siemens)
    - l) PT1000 (Sauter)
    - m) Ni1000 (Danfoss)
  - 2) Analog inputs
    - a) Current Input - 0-20 mA
    - b) Voltage Input 0-10 Vdc
  - 3) Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
  - 4) Digital outputs
  - 5) Analog outputs of 4-20 mA and/or 0-10 Vdc
13. Real Time Clock (RTC):
- a. Each BACnet/IP Fieldbus controller shall include a real time clock, accurate to +/-1 minute per month. The RTC shall provide the following: time of day, day, month, year, and day of week.
  - b. The RTC date and time shall also be accurate, up to 7 days, when the BACnet/IP Fieldbus controller is powerless.
  - c. No batteries may be used to for the backup of the RTC.
14. The BACnet/IP Fieldbus controller for Variable Air Volume (VAV) applications
- a. The BACnet/IP Fieldbus controller for VAV applications shall include a built-in 'flow thru' differential pressure transducer
  - b. The VAV differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. and measurement accuracy of  $\pm 5\%$  at 0.001 to 1 in. W.C. and a minimum resolution of 0.001 in. W.C., insuring primary air flow conditions shall be controlled and maintained to within  $\pm 5\%$  of setpoint at the specified minimum and maximum air flow parameters
  - c. The BACnet/IP Fieldbus controller for VAV applications shall support a dedicated commissioning tool for air flow balancing
  - d. The BACnet/IP Fieldbus controller for VAV applications shall require no programing for air balancing algorithm
  - e. All balancing parameters shall be synchronized in NSC
15. Each BACnet/IP Fieldbus controller shall have a minimum of 10% spare capacity for each point type represented on the controller for future point connection
16. Power Requirements.: 24VDC (21 to 33 VDC) and 24 VAC +/-20% with local transformer power
- F. Commissioning Tool - The BACnet/IP Fieldbus controller shall be supported via a dedicate mobile based commissioning tool for configuration, programming, air balancing and I/O checkout
- 1. The Commissioning Tool shall be supported across: iOS, Android and Windows 10 platforms
  - 2. The Commissioning Tool shall be available for download on App Store, Google Store and Windows Store

3. Commissioning Tool Interface to BACnet/IP Fieldbus controllers shall be via a Bluetooth adapter interface through the Intelligent Space Sensor or via a Wi-Fi access point on the LAN
4. Functionality
  - a. Device Configuration – the Commissioning Tool shall be able to set or edit all Network configurations associated with the BACnet/IP Fieldbus controller
  - b. Programming – The Commissioning Tool shall be able to load offline engineered applications directly in to the controller directly
  - c. Air Balancing
    - 1) The Commissioning Tool shall allow the air balancer to manually control the action of the actuator including the following function: open VAV damper, close VAV damper, open all VAV dampers, and close all VAV dampers.
    - 2) The Commissioning Tool shall be able to generate Air Balancing report
  - d. IO Checkout
    - 1) The Commissioning Tool shall be able to support overriding of the outputs and reading value of inputs live
    - 2) The Commissioning Tool shall be able to support generation of I/O checkout report
  - e. There shall be no limit to the number of Commissioning Tools that can be used on a network segment, however, one connection per controller is recommended
- G. Intelligent Space Sensors - The BACnet/IP Fieldbus controller shall support a dedicated RJ45 communication port to communicate and power up to 4 intelligent wall mount sensors without the use of on board inputs or outputs
  1. The Intelligent Space Sensor shall communicate with the BACnet/IP Fieldbus controller through the sensor port and via category 5 or category 6 cable
  2. The Intelligent Space Sensor shall provide 2 RJ45 communication ports that will allow communication with parent BACnet/IP Field controller upstream and additional Intelligent Space Sensors downstream
  3. The Intelligent Space Sensor shall provide ambient space condition sensing without the use of hardware I/O
- H. Each Intelligent Space Sensor shall provide a color touch display with:
  1. Minimum 61 mm (2.4") by 61 mm (2.4") display
  2. Backlit
- I. The Intelligent Space Sensor shall be capable of displaying measured space temperature from 0 to 50 °C (32 to 122 °F) with accuracy of  $\pm 0.2$  °C ( $\pm 0.4$  °F) selectable for 0.1 or 1 degree display resolution of °F or °C
  1. Sensing Element: 10k Type 3 Thermistor
  2. Accuracy of  $\pm 0.2$  °C ( $\pm 0.4$  °F)
  3. Resolution: 0.1 or 1 degree display resolution
  4. Range: 0 to 50 °C (32 to 122 °F)
- J. The Intelligent Space Sensor shall have the option for humidity sensor support sensing humidity from 0 % RH to 100 % RH Digital humidity indication (selectable for 0.1 or 1% RH with selectable display resolution of 0.1 or 1 % RH
  1. Accuracy:  $\pm 2$  % RH
  2. Resolution: 0.1 or 1 % RH
  3. Range: 0 % RH to 100 % RH

- K. The Intelligent Space Sensor shall have the option for support of CO2 sensor with display resolution with 0 to 2000 ppm resolution
  - 1. Accuracy:  $\pm 30$  ppm  $\pm 2\%$  of measured value
  - 2. Range: 0 to 2,000 ppm
  - 3. Operating elevation: 0 to 16,000 ft.
  - 4. Temperature dependence: 0.11% FS per °F
  - 5. Stability: <2% of FS over life of sensor (15 years)
  - 6. Sensing method: Non-dispersive infrared (NDIR), diffusion sampling
- L. The Intelligent Space Sensor shall have the option for motion sensor
- M. Display options: The Intelligent Space Sensor shall be capable of displaying the following elements:
  - 1. Space temperature
  - 2. Cooling space temperature set point
  - 3. Heating space temperature set point
  - 4. Current heating or cooling mode
  - 5. Current occupancy mode
  - 6. Fan speed
  - 7. Current time

## 2.6 BACNET FIELDBUS AND BACNET SDCUS

- A. Networking
  - 1. IP Network: All devices that connect to the WAN shall be capable of operating at 10 megabits per second or 100 megabits per second.
  - 2. IP To Field Bus Routing Devices
    - a. A Network Server Controller shall be used to provide this functionality.
    - b. These devices shall be configurable locally with IP crossover cable and configurable via the IP network.
    - c. The routing configuration shall be such that only data packets from the field bus devices that need to travel over the IP level of the architecture are forwarded.
- B. Field Bus Wiring and Termination
  - 1. The wiring of components shall use a bus or daisy chain concept with no tees, stubs, or free topology.
  - 2. Each field bus shall have a termination resistor at both ends of each segment.
  - 3. The field bus shall support the use of wireless communications.
- C. Repeaters
  - 1. Repeaters are required to connect two segments.
  - 2. Repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.
- D. Field Bus Devices
  - 1. General Requirements
    - a. Devices shall have a light indicating that they are powered.
    - b. Devices shall be locally powered. Link powered devices (power is furnished from a central source over the field bus cable) are not acceptable.

- c. Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings. (Battery backup, flash memory, etc.)

E. Advance Application Controllers (B-AAC)

1. The key characteristics of a B-AAC are:

- a. They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices, and binary output devices. The number and type of input and output devices supported will vary by model.
- b. They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O shall be provided by additional circuit boards that physically connect to the basic controller.
- c. The application to be executed by a B-AAC is created by an application engineer using the vendor's application programming tool.
- d. If local time schedules are embedded, the B-AAC shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.
- e. If local trend logging is embedded, the B-AAC shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
- f. If local alarm message initiation is embedded, the B-AAC shall:
  - 1) Deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient of the alarm message.
  - 2) Support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement,
- g. Shall support the reading of analog and binary data from any BACnet OWS or Building Controller that supports the BACnet service for the reading of data.
- h. Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
- i. Shall support the receipt and response to Time Synchronization commands from a BACnet Building Controller.
- j. Shall support the "Who is" and "I am." BACnet services.
- k. Shall support the "Who has" and "I have." BACnet services.

2. Analog Input Circuits

- a. The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
- b. For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
- c. For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two point calibration concept can be executed (both a low range value and a high range value are adjusted to match values determined by a calibration instrument).
- d. For non-linear sensors such as thermistors and flow sensors the B-AAC shall provide software support for the linearization of the input signal.

3. Binary Input Circuits
  - a. Dry contact sensors shall wire to the controller with two wires.
  - b. An external power supply in the sensor circuit shall not be required.
4. Pulse Input Circuits
  - a. Pulse input sensors shall wire to the controller with two wires.
  - b. An external power supply in the sensor circuit shall not be required.
  - c. The pulse input circuit shall be able to process up to 20 pulses per second.
5. True Analog Output Circuits
  - a. The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
  - b. The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.
6. Binary Output Circuits
  - a. Single pole, single throw or single pole, double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
  - b. Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.5 amps at 24 VAC.
7. Program Execution
  - a. Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
  - b. The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
  - c. The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
  - d. The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
  - e. The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of controller immediately following a power cycle.
8. Local Interface
  - a. The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
    - 1) Adjust application parameters.
    - 2) Execute manual control of input and output points.
    - 3) View dynamic data.

F. Application Specific Devices

1. Application specific devices shall have fixed function configurable applications.
2. If the application can be altered by the vendor's application programmable tool, the device is an advanced application controller and not an application specific device.
3. Application specific devices shall be BTL certified.

## 2.7 DDC SENSORS AND POINT HARDWARE

### A. Temperature Sensors

1. Acceptable Manufacturers: Veris Industries
2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of -30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
3. Room Sensor: Standard space sensors shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box. Basis of Design: Veris TW Series
  - a. Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
  - b. Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.
4. Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet. Basis of Design: Veris TD Series
5. Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing. Basis of Design: Veris TA Series
6. Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications. Basis of Design: Veris TI Series
7. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series
8. A pneumatic signal shall not be allowed for sensing temperature.

### B. Humidity Wall Transmitter

1. Acceptable Manufacturer: Veris Industries
2. Transmitters shall be accurate to +/- 2 % at full scale.
3. Transmitter shall have replaceable sensing element.
4. Sensor type shall be thin-film capacitive.
5. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
6. Operating range shall be 0 - 100% RH noncondensing, 50 to 95 F
7. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC.
8. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
9. Transmitter shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box.
10. Transmitter shall have option of having an LCD display
11. Transmitter shall have option of being NIST certified
12. Transmitter shall have option of an integrated temperature sensor

13. Basis of Design: Veris HWL Series

C. Humidity Duct Transmitter

1. Acceptable Manufacturer: Veris Industries
2. Transmitters shall be accurate to +/- 2 % at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall have option of being NIST certified
11. Transmitter shall have option of an integrated temperature sensor
12. Basis of Design: Veris HD Series

D. Humidity Outdoor Transmitter

1. Acceptable Manufacturer: Veris Industries
2. Transmitters shall be accurate to +/- 2% at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall have option of being NIST certified
11. Transmitter shall have option of an integrated temperature sensor
12. Basis of Design: Veris HO Series

E. Carbon Dioxide Wall Transmitter:

1. Acceptable Manufacturer: Veris Industries
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be  $\pm 30$  ppm  $\pm 2\%$  of measured value with annual drift of  $\pm 10$  ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be  $\pm 20$  ppm  $\pm 1\%$  of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable [Analog: 4-20mA or 0-5/0-10VDC][Protocol: Modbus or BACnet] with [SPDT Relay 1A@30VDC][temperature setpoint slider]
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: 32° to 122°F (CO2 only) (with humidity option)]
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Transmitter shall be available in an off white enclosure for mounting on a standard electrical box.



11. Transmitter shall have an option of an LCD display for commissioning and provide additional faceplate to conceal LCD display where occupants may misinterpret CO2 readings.
12. Transmitter shall have option of an integrated temperature sensor and/or humidity sensor
13. Basis of Design: Veris CWL

F. Carbon Dioxide Duct Transmitter:

1. Acceptable Manufacturer: Veris Industries
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be  $\pm 30$  ppm  $\pm 2\%$  of measured value with annual drift of  $\pm 10$  ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be  $\pm 20$  ppm  $\pm 1\%$  of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC with SPDT Relay 1A@30VDC
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: 32° to 122°F
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Enclosure shall not require remote pickup tubes and make use of integrated H-beam probe to channel air flow to sensor.
11. Enclosure lid shall require no screws and make use of snap on features for attachment
12. Enclosure shall be made of high impact ABS plastic
13. Transmitter shall have option of an LCD display
14. Transmitter shall have option of an integrated temperature sensor and/or humidity sensor
15. Basis of Design: Veris CDL

G. Air Pressure Transmitters.

1. Acceptable Manufacturers: Veris Industries
2. Sensor shall be microprocessor profiled ceramic capacitive sensing element
3. Transmitter shall have 14 selectable ranges from 0.1 – 10" WC
4. Transmitter shall be  $\pm 1\%$  accurate in each selected range including linearity, repeatability, hysteresis, stability, and temperature compensation.
5. Transmitter shall be field configurable to mount on wall or duct with static probe
6. Transmitter shall be field selectable for Unidirectional or Bidirectional
7. Maximum operating pressure shall be 200% of design pressure.
8. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC linear.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power
10. Response time shall be field selectable T95 in 20 sec or T95 in 2 sec
11. Transmitter shall have an LCD display
12. Units shall be field selectable for WC or PA
13. Transmitter shall have provision for zeroing by pushbutton or digital input.
14. Transmitter shall be available with a certification of NIST calibration
15. Basis of Design: Veris model PXU.

H. Liquid Differential Pressure Transmitters:

1. Acceptable Manufacturer: Veris Industries
2. Transmitter shall be microprocessor based

3. Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure
4. Transmitter shall have 4 switch selectable ranges
5. Transmitter shall have test mode to produce full-scale output automatically.
6. Transmitter shall have provision for zeroing by pushbutton or digital input.
7. Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.
8. Transmitter shall have field selectable electronic surge damping
9. Transmitter shall have an electronic port swap feature
10. Transmitter shall accept 12-30 VDC or 24 VAC supply power
11. Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.
12. Performance:
  - a. Accuracy shall be  $\pm 1\%$  F.S. and  $\pm 2\%$  F.S. for lowest selectable range
  - b. Long term stability shall be  $\pm 0.25\%$
  - c. Sensor temperature operating range shall be  $-4^{\circ}$  to  $185^{\circ}\text{F}$
  - d. Operating environment shall be  $14^{\circ}$  to  $131^{\circ}\text{F}$ ; 10-90% RH noncondensing
  - e. Proof pressure shall be 2x max. F.S. range
  - f. Burst pressure shall be 5x max. F.S. range
13. Transmitter shall be encased in a NEMA 4 enclosure
14. Enclosure shall be white powder-coated aluminum
15. Transmitter shall be available with a certification of NIST calibration
16. Transmitter shall be preinstalled on a bypass valve manifold
17. Basis of Design: Veris PW

I. Current Sensors

1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris Industries

J. Current Status Switches for Constant Load Devices

1. Acceptable Manufacturer: Veris Industries
2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
3. Visual LED indicator for status.
4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.
5. Normally open current sensor output. 0.1A at 30 VAC/DC.
6. Basis of Design: Veris Model H608.

K. Current Status Switches for Constant Load Devices (Auto Calibration)

1. Acceptable Manufacturer: Veris Industries.
2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A

5. Nominal Trip Point:  $\pm 40\%$ ,  $\pm 60\%$ , or on/off (user selectable)
  6. Normally open current sensor output. 0.1A at 30 VAC/DC.
  7. Basis of Design: Veris Model H11D.
- L. Current Status Switches for Variable Frequency Drive Application
1. Acceptable Manufacturer: Veris Industries.
  2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
  3. Visual LED indicator for status.
  4. Alarm Limits:  $\pm 20\%$  of learned current in every 5 Hz freq. band
  5. Split-core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
  6. Normally open current sensor output. 0.1A at 30 VAC/DC.
  7. Basis of Design: Veris Model H614.
- M. Liquid Flow, Insertion Type Turbine Flowmeter:
1. Acceptable Manufacturer: Veris Industries
  2. General: Turbine-type insertion flow meter designed for use in pipe sizes 1 1/2" and greater. Available in hot tap configuration with isolation valves and mounting hardware to install or remove the sensor from pipeline that is difficult to shut down or drain
  3. Performance:
    - a. Accuracy  $\pm 1\%$  of rate over optimum flow range;  $\geq 10$  upstream and  $\geq 5$  downstream straight pipe diameters, uninterrupted flow
    - b. Repeatability  $\pm 0.5\%$
    - c. Velocity Range: 0.3 to 20 FPS
    - d. Pressure Drop 0.5 psi or less @ 10 ft/sec for all pipe sizes 1.5" dia and up
    - e. Pressure Rating: 1000 psi @ 70°F
  4. Maximum Temperature Rating: 300°F
  5. Materials: Stainless Steel or Brass body; Stainless steel impeller
  6. Transmitter:
    - a. Power Supply: 12 - 30VAC or 8 - 35VDC.
      - 1) Output: 4-20 mA
    - b. Temperature Range: 14° to 150°F
    - c. Display: 8 character 3/8" LCD (Optional)
    - d. Enclosure: NEMA 4, Polypropylene with Viton® sealed acrylic cover
  7. Basis of Design: Veris SDI series
- N. Liquid Flow/Energy Transmitter, Non-invasive Ultrasonic (Clamp-on):
1. Acceptable Manufacturer: Veris Industries
  2. General: Clamp-on digital correlation transit-time ultrasonic flow meter designed for clean liquids or liquids containing small amounts of suspended solids or aeration. Optional temperature sensors for BTU calculations.
  3. Liquid: water, brine, raw sewage, ethylene, glycol, glycerin, others. Contact manufacturer for other fluid compatibility
  4. Pipe Surface Temperature: Pipe dia 1/2" to 2": -40-185°F; Pipe dia > 2": -40-250°F
  5. Performance:

- a. Flow Accuracy:
      - 1) Pipe dia 1/2" to 3/4" 1% of full scale
      - 2) Pipe dia 1" to 2" 1% of reading from 4-40 FPS
      - 3) Pipe dia 2" to 100" 1% of reading from 1-40 FPS
    - b. Flow Repeatability  $\pm 0.01\%$  of reading
    - c. Velocity Range: (Bidirectional flow)
      - 1) Pipe dia 1/2" to 2" 2 to 40 FPS
      - 2) Pipe dia 2" to 100" 1 to 40 FPS
    - d. Flow Sensitivity 0.001 FPS
    - e. Temperature Accuracy (energy): 32-212°F; Absolute 0.45°F; Difference 0.18°F
    - f. Temperature Sensitivity: 0.05°F
    - g. Temperature Repeatability:  $\pm 0.05\%$  of reading
  - 6. Transmitter:
    - a. Power Supply: 95 to 264 VAC, 47 to 63 Hz or 10 to 28 VDC.
    - b. Output: 4-20 mA
    - c. Temperature Range: -40 to +185°F
    - d. Display: 2 line backlit LCD with keypad
    - e. Enclosure: NEMA 4, (IP65), Powder-coated aluminum, polycarbonate
  - 7. Agency Rating: UL 1604, EN 60079-0/15, CSA C22.2, CSA Class 1 (Pipe > 2")
  - 8. Basis of Design: Veris FST & FSR series
- O. Analog Electric/Pneumatic Transducer:
- 1. Acceptable Manufacturer: Veris Industries
  - 2. General: Micro-controlled poppet valve for high accuracy and with no air loss in the system. Field configurable for pressure sensing in multiple applications.
  - 3. Power Supply: 22-30VDC, 20-30VAC
  - 4. Control Input: 4-20mA, 0-10V, 0-5V; jumper selectable
  - 5. Performance:
    - a. Accuracy: 1% full scale; combined linearity, hysteresis, repeatability
    - b. Compensated Temperature Range: 25° to 140°F
    - c. Temp Coefficient:  $\pm 0.05\%^\circ\text{C}$
    - d. Operating Environment: 10-90% RH, non-condensing; 25° to 140°F
  - 6. Supply Pressure: 45 psig max.
  - 7. Manual Override: Jumper selectable mode, digital pushbutton adjust
  - 8. Alarm Contact: 100mA@30VAC/DC (Optional)
  - 9. Control Range 0-20 psig or 3-15 psig; jumper selectable
  - 10. Pressure Differential 0.1 psig (supply to branch)
  - 11. Pressure Indication Electronic, 3-1/2 digit LCD
  - 12. Housing: Mounted on standard SnapTrack; Optional clear dust cover
  - 13. Basis of Design: Veris EP Series
- P. Control Valves
- 1. Ball Valves
    - a. 1/2" to 3/4" Ball Valve
      - 1) Forged brass body rated at no less than 600 psi, chrome plated brass ball with blowout proof stem or optional stainless steel ball with blowout proof stem,

- 2) Valves are to be in two-way and three-way configurations.
  - 3) Connection: Female NPT end fittings, Teflon® PTFE seat, characterizing disc glass filled PEEK providing equal percentage flow curve on two-way valve.
  - 4) Operating Temperature 20...250°F chilled or hot water with up to 60% glycol solution.
  - 5) Two-way and Bypass port should be ANSI Class IV (0.01% of Cv) seat leakage.
  - 6) Rangeability must be at least 300:1.
  - 7) Tool-less actuator connection.
  - 8) System Static Pressure Limit should be 600 psig (4137 Pa)
  - 9) Basis of Design: Schneider Electric VBB/VBS Ball Valves, or approved equal.
- b. ½" to 3" 2-way and ½" to 2" 3-way Ball Valves
- 1) Valves must be for control of hot or chilled water, or solutions of up to 50% glycol.
  - 2) Ball valves must have close-offs of 40...130 psi depending on size.
  - 3) Valves will provide CVs from 0.33...266 depending on size.
  - 4) Valve characterizing insert is to be made of glass-filled Noryl™ and provide equal percentage flow.
  - 5) Valve body is to be made of forged brass ASTM B283-06 and rated for static pressure of 360 psi at fluid temperatures of 20...250°F (-7...121°C).
  - 6) All valves are to have balls made of nickel/chromium plated brass with two-way valves having stainless steel balls as an option. All valve stems are to be stainless steel with reinforce Teflon® EPDM O-ring seals.
  - 7) 2-way valves are to be ANSI Class IV (0.01% of Cv) shutoff. 3-way valves are to be ANSI Class IV (0.01% of Cv) piped coil-side outlet to the port A only.
  - 8) Fluid (water) temperature are a minimum 20°F (-7°C) and a maximum of 250°F (121°C).
  - 9) Basis of Design: Schneider Electric VB-2000 or approved equal.
2. Globe Valves (Bronze ½" to 2")
- a. Control Valves: Factory fabricated, with body material, and pressure class based on maximum pressure and temperature rating of piping system with a body rating of not less than 400 psig at 150°F, 321 psig at 281°F per ANSI B16.15.
  - b. Valves two way NPS 2" and Smaller: Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Material grade properties must meet the fluid temperature and pressure requirements:
    - 1) Standard duty bronze body, 316 stainless steel vertical stem, brass plug, soft seal, and bronze seat, renewable packing cartridge, and screwed/sweat/flared ends. Valves shall have allowable media temperature of 20°F ...281°F to assure reliability with dual temperature applications.
    - 2) Heavy duty bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, soft seal, and 316 stainless steel seat, renewable packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F ...340°F to assure to assure reliability with dual temperature applications.
    - 3) High temperature bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, and 316 stainless steel seat, renewable packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F ...400°F.
  - c. Two-way fluid system globe valves shall have the following characteristics:
    - 1) Rangeability: Greater than 100:1 for all valves with flow coefficients of 0.4 and higher to provide stable control under light load conditions.

- 2) Maximum Allowable Seat Leakage: Standard and heavy duty valves must be designed to meet ANSI Class V (0.0005 ml per minute per "of orifice diameter per psi differential) up to 35 psi close off differential pressure and ANSI Class IV seat leakage (maximum 0.01% of full open valve capacity) above 35 psi with appropriate actuator. High temperature valves must meet ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
  - 3) The valve must be able to operate with a full-open operating differential of no less than 87 psi.
  - 4) Flow Characteristics: Modified equal percentage characteristics for standard duty water applications and modified linear for heavy duty and high temperature steam applications with gradual opening for light loads.
  - 5) Sizing:
    - a) Two Position Water: Water: Line size or size using a differential pressure of 1 psi.
    - b) Modulating Water: 5 PSI or twice the load pressure drop.
    - c) Pressure drop across steam valve at a maximum flow of 80 percent of inlet pressure up to 15 psig and 42% of absolute (gage pressure + 14.7) inlet pressure above 15 psig inlet.
    - d) 100 psi saturated steam maximum inlet pressure for heavy duty bronze body globe valves ½"...2".
    - e) 150 psi saturated steam maximum inlet pressure for high temperature bronze body globe valves ½"...2".
    - f) 35 psi saturated steam maximum inlet pressure for standard duty bronze body globe valves ½"...2".
- d. Valves 3-Way mixing (two inlets and one outlet) NPS 2" and Smaller:
- 1) Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Material grade properties must meet the fluid temperature and pressure requirements:
    - a) Standard duty bronze body, 316 stainless steel vertical stem, brass plug, and bronze seat, renewable packing cartridge, and screwed or sweat ends. Valves shall have allowable media temperature of 20°F...281°F to assure reliability with dual temperature applications.
    - b) Heavy duty bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, and 316 stainless steel seat, renewable disc and packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F ...340°F to assure reliability with dual temperature applications.
- e. 3-Way mixing hydronic system globe valves shall have the following characteristics:
- 1) Rangeability: Greater than 100:1 for all valves to provide stable
  - 2) Maximum Allowable Seat Leakage: A port must be designed to meet ANSI Class V (0.0005 ml per minute per "of orifice diameter per psi differential) up to 35 psi close off differential pressure and ANSI IV seat leakage (maximum 0.01% of full open valve capacity) above 35 psi with appropriate actuator. B port must meet ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
  - 3) The valve must be able to operate with a full-open operating differential of 87 psi.
  - 4) Flow Characteristics: Modified linear characteristics with gradual opening for light loads.
  - 5) Sizing: Modulating Water: Minimum 5 psi or at least equal to the load pressure drop.
- f. Valves 3-Way diverting (one inlet and two outlets) NPS 2" and Smaller:

- 1) Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Valves must be designed specifically for diverting service, and mixing valves designed for mixing service must not be used for diverting applications. Material grade properties must meet the fluid temperature and pressure requirements; Standard duty bronze body, 316 stainless steel vertical stem, brass plug, and bronze seat, renewable disc and packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F ...281°F to assure reliability with dual temperature applications.
- g. 3-Way diverting hydronic system globe valves shall have the following characteristics:
  - 1) Rangeability: Greater than 100:1 for all valves to provide stable control under light load conditions.
  - 2) Maximum Allowable Seat Leakage: ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
  - 3) Maximum Allowable Pressure Differential: 35 psi in an open position.
  - 4) Flow Characteristics: Modified linear characteristics with gradual opening for light loads.
  - 5) Sizing, Modulating Water: Minimum 5 psi or at least equal to the load pressure drop.
- h. Required Certifications: Pressure Equipment Directive (PED 97/23/EC), RoHS (Restriction of Hazardous Substances) and REACH (Regulation, Evaluation, Authorization, and Restriction of Chemicals), Canadian Registration Number.
- i. Valve and Operator: To assure maximum performance and operation of the valve assembly both the valve and the actuator must be tested and approved by the valve manufacturer to assure compatibility of all components and performance to the specifications.
- j. Basis of Design: Schneider Electric Venta VB-7000, or approved equal.
3. Butterfly Valves
  - a. Valve body are to be polyester coated iron ASTM A126 lug mating with ANSI class 125/150 flanges.
  - b. Disc Type: Ductile iron nylon 11 coated.
  - c. Valve Stem:
    - 1) 2...8" 416 stainless steel double D stem.
    - 2) 10...12" 316 stainless steel double D stem.
    - 3) 14" and larger: stainless steel round shaft woodruff key slot.
  - d. Valve seat: EPDM tongue and groove seat and molded O-ring flange seat
  - e. Flow Characteristics: Modified equal percentage.
  - f. Close-Off Pressure Rating: Bubble-tight shutoff (no leakage).
  - g. Valve fluid temperature rating: -40...250°F (-40...121°C) 9. Valve will have two (2) inch extended neck (because of heat). 10. Valve must except pneumatic or electric/electronic actuators 11. Valves must have a minimum of a two (2) year warranty.
4. Flanged Valves
  - a. Bodies: Shall be American Factory fabricated with ASTM A 126 Class B cast iron body material with the pressure class within the maximum pressure and temperature rating of the piping system. (125 body rating with not less than 200 psig at 150°F, decreasing to 169 psig at 281F per ANSA B16.1)
  - b. Serviceability: 2-Way valve operators, stem and plug assemblies and spring-loaded PTFE/EPDM valve stem packing cartridges must be removable for future replacement to restore the valves back to their original condition.

- c. Construction: Material grades must meet the fluid temperature and pressure requirement temperatures of 20°F ...281°F to assure reliability throughout all application temperature ranges.
- d. Packings: Shall be cartridges suitable for replacement as units withstanding the full operating temperature ranges, including daily and seasonal fluctuations of water, 60% glycol and steam fluids.
- e. Characteristics
  - 1) Rangeability: Two way, 100:1 and greater for stable control under light load.
  - 2) Shutoff, 2-Way: Leakage allowed: ANSI Class IV (0.01% of max flow)
  - 3) 3-Way: Leakage allowed: ANSI Class III (0.1% of max flow)
  - 4) Flow curves: 2-Way modified equal percentage characteristic.
  - 5) Mixing and Diverting: Linear, modified with gradual opening for light loads.
- f. Piping
  - 1) Diverting valves, with the common port at the bottom can be used for mixing.
  - 2) Mixing valves with the common port at the end must not be used for diverting applications.
- g. Sizing
  - 1) Two Position Water: Line size or size using a differential pressure of 1 psi.
  - 2) Modulating Water: 5 PSI or twice the load pressure drop
  - 3) Steam, 2-Way: maximum pressure drop across the valve at a maximum flow of 80 percent of inlet pressure up to 15 psig. Above 15 psig inlet, 42% of absolute (gage pressure + 14.7) inlet pressure.
- h. Certifications for All Models: Pressure Equipment Directive (PED 97/23/EC), RoHS (Restriction of Hazardous Substances) and REACH (Regulation, Evaluation, Authorization, and Restriction of Chemicals)
- i. Basis of Design: Schneider Electric VB-8000 and VB-9000 valves, or approved equal.

Q. Control Valve Actuators

- 1.  $\frac{1}{2}$ " to  $\frac{3}{4}$ " Ball Valve Actuators
  - a. Size for torque required for valve close-off pressure for system design.
  - b. Coupling: Direct coupled to valve body without use of external devices/tools
  - c. Auxiliary End Switch (optional) to be SPST 24 Vac/Vdc, 101 mA to 5 mA maximum on selected two-position models.
  - d. Controller Signal Two-position, Floating or Proportional (0...5 Vdc, 0...10 Vdc, 5...10 Vdc, or 4...20 mA dc). Design allows for change via DIP switches without removal of cover.
  - e. Manual operating lever and position indicator must be standard.
  - f. Power Requirements: 24 Vac for floating, proportional, and 110...230 Vac for two position multi-voltage types
  - g. Actuators must be available with either Spring Return (SR) or Non-Spring Return (NSR) models.
  - h. Wiring (depending on model) Removable Terminal Block, 10 ft. (3.05 m) Plenum Cable, 18 in. (45 cm) Appliance Wire
  - i. Locations must be rated NEMA 2, IEC IP31. (Indoor Use Only.) Actuators with terminal block or plenum cable leads are plenum rated per UL file number E9429.
  - j. Agency Listings: ISO 9001, cULus, and CE.
  - k. Basis of Design: Schneider Electric VBB/VBS, or approved equal.
- 2.  $\frac{1}{2}$ " to 3" 2-way and  $\frac{1}{2}$ " to 2" 3-way Ball Valves Actuators
  - a. Size for torque required for valve close-off pressure for system design.



- b. Actuators are to be available in spring return (SR) and non-spring return (NSR) models. Spring Return (SR) actuators are to provide a choice to return direction.
  - c. Actuators are to be available in models for two-position, floating and proportional control.
  - d. All actuator models are to be equipped with pigtail leads, manual override, and auxiliary switch(es)
  - e. Operating temperatures' Floating Non-Spring Return (NSR) with 33 lb.-in. of torque must be -25 to 130 °F (-32 to 55°C). All other actuators are to -22 to 140 °F (-30 to 60 °C)
  - f. Actuators must be NEMA 2 rated.
  - g. Agency Listings: ISO 9001, cULus, and CE.
  - h. Basis of Design: Schneider Electric VB-2000, or approved equal.
3. ½" to 2" Bronze, Linear Globe Valve Actuators/67 or 78 lbs. force
- a. Actuator must have bi-color LED status indication for motion indication, auto calibration and alarm notification.
  - b. When the actuator is properly mounted must have a minimum of a NEMA 2 (IP53) rating.
  - c. Actuators are to be non-spring return.
  - d. Actuators are to be floating (used for two-position) or proportional models.
  - e. Proportional models will have optional models with a position output signal with field selectable 2...10 Vdc and 0...10 Vdc input signals and selectable input signal direct or reverse acting.
  - f. Actuator must have auto calibration which provides precise control by scaling the input signal to match the exact travel of the valve stem
  - g. Actuators must come in models with Pulse Width Modulated (PWM) with field selectable 0.59 to 2.93 sec and 0.1 to 25.5 sec input signal ranges with a position output signal
  - h. Actuators must have manual override with automatic release.
  - i. Models with position feedback output signal include field selectable 2...10 Vdc or 0...5 Vdc output signal
  - j. Removable wiring screw terminal with ½" conduit opening.
  - k. Actuator agency Listings: cUL-us LISTED mark, NEMA 2, NEC class 2 FCC part-15 class B, Canadian ICES-003, ESA registered, Plenum rated per UL 20430
  - l. Basis of Design: Schneider Electric MG350V, or approved equal.
4. ½" to 2" Bronze, Linear Globe Valve Actuators/105 lbs. force
- a. Actuators must have Two- Position, Floating, and Proportional models.
  - b. Proportional models will a controller input signal of either a 0...10 Vdc, 2...10 Vdc, 4...20 mAdc, 0...3 Vdc, or 6...9 Vdc. Control function direct/reverse action is switch selectable on most models.
  - c. Actuator force is to be 105 lb. (467 newton) with ½" (13 mm) nominal linear stroke
  - d. Power requirements 24 Vac, 120 Vac or 230 Vac depending on model.
  - e. Actuator housings rated for up to NEMA 2/ IP54.
  - f. Actuator is to have overload protection throughout stroke.
  - g. Actuator must automatically set input span to match valve travel.
  - h. Actuator must have manual override to allow positioning of valve and preload.
  - i. Actuator is to be spring return.
  - j. Actuator is to mount directly to valves without separate linkage.
  - k. Actuator agency Listings: UL 873, CUL: UL

- I. Basis of Design: Schneider Electric SmartX Mx51-7103, or approved equal
5. ½" to 2" Bronze, Linear Globe Valve Actuators/220 lbs. force
  - a. Actuators must have Two- Position for a SPST controller, Floating for a SPST controller, and Proportional models will a controller input signal of either a 0...10 Vdc, 2...10 Vdc, 4...20 mAdc, or 6...9 Vdc. Control function direct/reverse action is jumper selectable
  - b. Actuator is to be spring return.
  - c. Actuator will have 220 lb. force (979 newton) with ½" (13 mm) or 1" (25 mm) nominal linear stroke
  - d. Feedback on proportional model with 2...10 Vdc (max. 0.5 mA) output signal or to operate up to four like additional slave actuators.
  - e. Actuator must automatically set input span to match valve travel
  - f. Actuator is to have a 24 Vac power supply on Two-position and Proportional models and 120 Vac on Two-position models.
  - g. Actuator housings rated for up to NEMA 2/ IP54
  - h. Actuator must have manual override to allow positioning of valve and preload
  - i. Actuator is to mount directly to vales without separate linkage.
  - j. Actuator agency Listings: UL 873, CUL: UL
  - k. Basis of Design: Schneider Electric SmartX Mx51-720x, or approved equal.
6. ½" to 2" Bronze, Linear Globe Valve Actuators with linkage SR
  - a. Actuators with 35, 60, 133, or 150 lb.-in of force depending on model.
  - b. Actuator housings rated for up to NEMA 2/ IP54 with a 150 lb.-in. rated a NEMA 4.
  - c. Actuators are to be spring return.
  - d. Actuators are to have Two-position, Floating and Proportional models.
  - e. Actuators must have overload protection throughout rotation.
  - f. Actuator have an optional built-in auxiliary switch to provide for interfacing or signaling on selected models.
  - g. Actuator agency listings: UL-873, C22-2 No.24-83, CUL0
  - h. Basis of Design: Schneider Electric SmartX, or approved equal.
7. ½" to 2" Bronze Body, Linear Globe Valve Actuators with linkage SR & NSR
  - a. Actuators are to be either floating SPDT control or proportional control 0...10, 2...10 Vdc or 4...20 mA with a 500-ohm resistor included.
  - b. Actuators are to be direct/reverse with selectable DIP switches.
  - c. Actuators are to have 90 lb. (400N), 180 lb. (800N), or 337 lb. (1500N) of force on Non-Spring Return (NSR) 157 lb. of force on the Spring Return model. Note: Not every actuator is for every valve.
  - d. Actuators are to be powered with 24 Vac or 24 Vdc.
  - e. All Non-Spring Return (NSR) actuators are to be NEMA 2, vertical mount only. Spring Return (SR) actuators are to have NEMA 4 models.
  - f. Actuators must have manual override to allow positioning of the valve.
  - g. Actuators must have selectable valve sequencing and flow curves of either equal percentage or linear.
  - h. Actuators must have feedback.
  - i. Actuators must have internal torque protection throughout stroke.
  - j. 90°F (32°C) ambient at 366°F (186°C) fluid temperature
  - k. Actuator agency listings (North America) UL873, cULus, RCM, CE

- I. Basis of Design: Schneider Electric Forta M400A-VB, M800A-VB, M900A and M1500x-VB screw mounted on Venta VB7000s, or approved equal.
- R. Damper Actuators
  1. Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque.
  2. Direct-coupled damper actuators must have a five-year warrantee.
  3. Size for torque required for damper seal at maximum design conditions and valve close-off pressure for system design.
  4. Overload protected electronically throughout rotation except for selected Floating actuators the have a mechanical clutch.
  5. Spring Return Actuators: Mechanical fail safe shall incorporate a spring-return mechanism.
  6. Non-Spring Return Actuators shall stay in the position last commanded by the controller with an external manual gear release to allow positioning when not powered.
  7. Power Requirements: 24Vac/dc [120Vac][230Vac]
  8. Proportional Actuators controller input range from 0...10 Vdc, 2...10 Vdc or 4...20 mA models.
  9. Housing: Minimum requirement NEMA type 2
  10. Actuators with a microprocessor should not be able to be modified by an outside source (cracked or hacked).
  11. Actuators of 133 and 270 lb.-in. of torque or more should be able to be tandem mount or "gang" mount.
  12. Agency Listings: ISO 9001, cULus, CE and CSA
  13. Basis of Design: Schneider Electric SmartX Actuators, or approved equal.
- S. Smoke Detectors
  1. Air duct smoke detectors shall be by Air Products & Controls or approved equal. The detectors shall operate at air velocities from 300 feet per minute to 4000 feet per minute.
  2. The smoke detector shall utilize a photoelectric detector head.
  3. The housing shall permit mechanical installation without removal of the detector cover.
  4. The detectors shall be listed by Underwriters Laboratories and meet the requirements of UL 268A.
- T. Airflow Measuring Stations
  1. Provide a thermal anemometer using instrument grade self heated thermistor sensors with thermistor temperature sensors.
  2. The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section 23 00 00 and Drawings.
- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
- E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- F. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.
- G. Demolition: Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.
- H. Access to Site: Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's Representative.
- I. Code Compliance: All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.
- J. Cleanup: At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

### 3.2 SYSTEM ACCEPTANCE TESTING

- A. All application software will be verified and compared against the sequences of operation.
- B. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
- C. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
- D. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.
- E. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

### 3.3 INSTALLATION

#### A. Hardware Installation Practices for Wiring

1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
2. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
3. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
4. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
5. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
6. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
7. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
9. Wire will not be allowed to run across telephone equipment areas.
10. Provide fire caulking at all rated penetrations.

#### B. Installation Practices for Field Devices

1. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
2. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
3. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
5. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
6. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

#### C. Wiring, Conduit, and Cable

1. All wire will be copper and meet the minimum wire size and insulation class listed below:
  - a. Power - 12 Gauge - 600 Volt
  - b. Class One - 14 Gauge Std. - 600 Volt
  - c. Class Two - 18 Gauge Std. - 300 Volt
  - d. Class Three - 18 Gauge Std. - 300 Volt
  - e. Communications - Per Mfr.

2. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
3. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
4. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
5. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
6. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
7. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
8. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.
9. Only glass fiber is acceptable, no plastic.
10. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS system supplier shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

#### D. Enclosures

1. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
2. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
3. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
4. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
5. All outside mounted enclosures shall meet the NEMA-4 rating.
6. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

#### E. Identification

1. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
2. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
3. Junction box covers will be marked to indicate that they are a part of the BAS system.
4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
5. All I/O field devices inside FIP's shall be labeled.

F. Existing Controls.

1. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.

G. Location

1. The location of sensors is per mechanical and architectural drawings.
2. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
3. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
4. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

H. Software Installation

1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

### 3.4 TRAINING

A. The BAS system supplier shall provide both on-site and classroom training to the Owner's representative and maintenance personnel per the following description:

B. On-site training shall consist of a minimum of 8 hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include

1. System Overview
2. System Software and Operation
3. System access
4. Software features overview
5. Changing setpoints and other attributes
6. Scheduling
7. Editing programmed variables
8. Displaying color graphics
9. Running reports
10. Workstation maintenance
11. Viewing application programming
12. Operational sequences including start-up, shutdown, adjusting and balancing.
13. Equipment maintenance

C. Factory, classroom training will include a minimum of (2) training reservations for a 3 day course with material covering workstation operation tuition free with travel expense responsibility of the owner. The option for 2-3 weeks of system engineering and controller programming shall be possible if necessary and desired.

### 3.5 CONTROL SYSTEM SWITCH-OVER

A. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.

- B. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over.
- C. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

### 3.6 DATABASE CONFIGURATION.

- A. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

### 3.7 COLOR GRAPHIC DISPLAYS.

- A. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

### 3.8 REPORTS.

- A. The Contractor will configure a minimum of 4 reports for the owner. These reports shall, at a minimum, be able to provide:
  - 1. Trend comparison data
  - 2. Alarm status and prevalence information
  - 3. Energy Consumption data
  - 4. System user data

### 3.9 POINT TO POINT CHECKOUT.

- A. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.
- B. In case of wireless devices, the signal strength recorded during checkout shall be reported.

### 3.10 CONTROLLER AND WORKSTATION CHECKOUT.

- A. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

### 3.11 DOCUMENTATION

- A. As built software documentation will include the following:
  - 1. Descriptive point lists
  - 2. Application program listing
  - 3. Application programs with comments.
  - 4. Printouts of all reports.
  - 5. Alarm list.
  - 6. Printouts of all graphics



7. Commissioning and System Startup
8. An electronic copy of all databases, configuration files, or any type of files created specifically for each system.

END OF SECTION 230923.11



## SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.5 SUMMARY

- B. This Section includes control sequences for HVAC systems, subsystems, & equipment.

#### 1.6 RELATED DOCUMENTS

- B. Drawings & general provisions of the Contract, including General and Supplementary Conditions & Division 01 Specification Sections, apply to this Section.
- C. Related Sections include the following Division 23 Section 230923.11 Instrumentation & Control for HVAC for control equipment & devices & for submittal requirements.
- D. Reference the ATC diagrams for Unit configuration, ATC devices, point types & locations

#### 1.7 COORDINATED SEQUENCES & ATC DIAGRAMS

- B. Project ATC Diagrams: The Sequences of Operations detailed below are predicated on the specific Project ATC diagrams. Reference the ATC Diagrams for the Unit configuration, ATC control devices, point types & locations for each device.
- C. Control Sequence Descriptions: The control sequences below describe all necessary equipment operation including those operations that are provided by the HVAC Equipment Unit manufacturers (UM) & those as part of the Automatic Temperature Controls system (ATC). Due to the nature of the project, the control sequences will require field adjustment and modification. The ATC contractor shall provide all modifications to the sequences as requested by the MEP during the commissioning of the BMS.

#### 1.8 RESPONSIBILITIES

- B. Automatic Temperature Control (ATC) Contractor's Responsibilities: The ATC contractor (ATC) shall provide, field install & wire all necessary software & hardware, wiring, & computing equipment in compliance with this specification. The ATC contractor shall also provide programming, interface design, startup services by competent technicians that regularly employed by the ATC contractor with full responsibility for proper operation of the control system including debugging & proper calibration of each component in the entire system. The ATC contractor (ATC) shall provide power supply wiring to all external control panels, actuators (valves, dampers, etc.), including low voltage transformers, including the power for devices required for operation of BACnet communication as provided as part of complete HVAC Equipment Unit Manufacturer provided BACnet packaged.

#### 1.9 ROOFTOP UNIT RTU-1 (GAS HEATING DX, ECONOMIZER AND ENERGY RECOVERY).

General:

The BAS Contractor shall provide a BacNet-based DDC controller and provide all required controls to perform the sequence of operation below and as indicated on the controls diagram.

This is a packaged system that includes all components indicated on the equipment schedule. The Unit manufacturer shall provide all safeties as specified under the equipment plans and specifications.

The unit is indexed for occupied/unoccupied mode of operation from the LAN gateway. The Unit shall maintain a 72 deg. F (adj.) Space Temperature.

- A. Zone Optimal Start:  
The controller shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- B. Zone Unoccupied Override:  
The space sensors have a local occupancy override button with a led indication light. When the user depresses the occupancy override button, the led will light and the unit will index into the occupied mode of operation for up to 3 hours (adj). Upon the expiration of the override, the unit is placed into its scheduled mode of operation.
- C. Unoccupied mode:  
The fans are off. The outdoor, return and exhaust air dampers will remain in their full return position with the outside and exhaust dampers closed. The DX cooling and gas heating are "off". When the space temperature falls below 60 deg. F (adj) the supply air fan will cycle on until the space temperature is above 62 deg. F. (adj). During the unoccupied mode the DX cooling and gas heat will remain off.
- D. Occupied mode:  
The fans are on and will continue to run to maintain the space temperature set point. The manufacturer's economizer will proportionately position the economizer dampers and relief air. A current switch will monitor the status of the unit fans. An alarm will be initiated whenever the fan is not in the anticipated operation.
- E. Heating mode enable:  
When the outdoor air temperature drops below 65 deg. F. (adj), the DDC controller will enable the use of the heating mode.
- F. Cooling mode enable:  
When the outdoor air temperature rises above 65 deg. F. (adj), the DDC controller will enable the use of the mechanical cooling mode.
- G. Heating mode:  
The space sensor will, through the DDC controller, index the gas furnace to maintain the space temperature set point. If the space temperature falls below the space temperature set point, the controller will index the gas furnace "on" until the space temperature rises to the space set point. If the space temperature rises above the space temperature set point, the controller will index the gas furnace "off" until the space temperature falls to the space set point. An averaging type low limit discharge air sensor shall override the control of gas furnace to prevent the discharge air from falling below 55 deg. F. (adj) regardless of space temperature.
- H. Warm-up mode:  
Prior to occupancy mode, the unit will go into a warm-up mode, if the space temperature falls below 66 deg. F. (adj). The economizer dampers will go to the full recirculation position, and the gas furnace will be energized to maintain a discharge air temperature of 85 deg. F. (adj). Once the return air temperature or average space temperature returns above 70 deg. F. (adj) the warm-up mode will be deactivated and the unit will return to normal occupied mode.

I. Free cooling mode:

The DDC Controller will enable the economizer mode when the outside air temperature is less than 65F (adj); the outside air enthalpy is less than 22 BTU/b (adj) and the outside air temperature is less than the zone air temperature and proportionately position the economizer dampers. A mixed air averaging type sensor will maintain a mixed air temperature set point (55 deg. F.) (adj) by modulating the mixed air dampers.

J. Mechanical cooling mode:

When the use of mechanical cooling is selected the economizer dampers will be fixed at their minimum outdoor air position and the space temperature sensor will, through the DDC controller, stage the DX cooling to maintain the space air temperature set point. If the space air temperature rises above the space temperature set point, the controller will stage the DX cooling "on" until the space air temperature falls to the space set point. If the space air temperature falls below the space temperature set point, the controller will stage the DX cooling "off". During the mechanical cooling mode the gas furnace will remain "off".

K. Heat Recovery Wheel:

The DDC controller or Manufacturer provided Heat Recovery Wheel Module shall run the heat recovery wheel for energy recovery as follows:

1. Cooling Recovery Mode:

The controller shall measure the heat wheel discharge air temperature and run the heat wheel to maintain a set point of 2°F (adj) less than the unit supply air temperature set point. The heat wheel shall run for cool recovery whenever the unit's return air temperature is 5°F (adj) or more below the outside air temperature, the unit is in a cooling mode, the economizer is off and the supply fan is on. When economizer mode is "ON" the energy recovery wheel will be commanded to stop rotating to allow air flow to go through.

2. Heating Recovery Mode:

The controller shall measure the heat wheel discharge air temperature and run the heat wheel to maintain a set point of 2°F (adj.) less than the unit supply air temperature set point. The heat wheel shall run for heat recovery whenever the unit's return air temperature is 5°F (adj) or more above the outside air temperature, the unit is in a heating mode, the economizer is off and the supply fan is on. When economizer mode is "ON" the energy recovery wheel will be commanded to stop rotating to allow air flow to go through.

3. Dehumidification:

The unit will be provided with a hot gas reheat coil which has the ability to remove the moisture out of the space after the dry bulb temperature set point has been satisfied. The hot gas reheat coil will provide a controlled amount of reheat to the space to meet actual dehumidification requirement. When the space temperature is satisfied but the space humidity is above the humidity set point, the compressors will continue to operate and the factory controlled hot gas reheat control valves will modulate the amount of hot gas refrigerant gas passing through the reheat coil. The valve positions are controlled to provide a reset supply air temperature set point from a field supplied 0-10VDC reset signal at the BMS system.

4. Demand Control Ventilation (DCV):

Two CO2 sensors room mounting varies the ventilation dampers' minimum ventilation position between two adjustable values (one for low volumetric flow set at 1200 CFM (20%) highly variable occupancy and one for full occupancy of 6,000 CFM (100%) to reduce outside air cfm during low occupancy periods. The BMS shall have an output to energize one exhaust fans during DCV operation complete with exhaust cycle setpoint(s). The BMS shall have status for economizing, occupancy, calls for cooling from room controller, mixed air temperature, outdoor air temperature, return air temperature, CO2 level in space (the actual indoor set at 1,920 ppm), DCV on/off and exhaust fan on/off. The BMS shall include discharge or mixed air sensor to control mixing dampers during periods when outside air is sensed as suitable for

free cooling. The BMS shall modulate the outdoor air intake damper to maintain/satisfy space CO2 set-point concentration of 1,920 ppm. The controls system will have a fast response so the CO2 concentration will never exceed the set point of 1,920 ppm. The table below shows the extreme of damper positions with respect to the fraction of outside air:

OA	Exhaust Air Damper	Mixed Air Damper	Outside Ait Damper
0.20	20% open	80% open	20% open
0.25	25% open	75% open	25% open
0.50	50% open	50% open	50% open
1.0	100% open	0% open	100 % open

5. Start-up Purge Cycle:

When the RTU-1 starts, the outdoor air damper shall open, initiating a timed purge cycle. The outdoor air damper shall modulate to maintain the mixed airflow at 100% Max. outdoor air as listed on RTU schedule M6.01 drawing. The purge period shall be adjustable and shall initially be set for 30 minutes.

6. Post-occupancy purge: A post-purge must be provided to reduce CO2 concentration in the space down to ambient (outdoor air) level. The RTU will operate such that the fans and dampers are positioned to provide outside volumetric air flow between the minimum and maximum flow rates listed in the RTU shedule Dwg. M6.01. The post-purge period shall be adjustable and shall initially be set for 30 minutes.

7. The RTU-1 shall modulate its preheat control to maintain the discharge air temperature set-point if the mixed air temperature falls below the RTU-1 discharge air temperature setpoint. At the conclusion of the timed cycle, the outdoor air damper shall modulate closed to maintain the base ventilation rate of 20% outdoor air, and the demand controlled ventilation control algorithm shall be enabled.

l) Safeties and alarms:

Alarms shall be generated if any equipment for which a status feedback sensor is specified fails to operate when commanded or does not operate within the parameters (pressure, temperature, etc.) set by the Owner and/or the requirements of the engineer.

Alarms shall be generated if any equipment for which a status sensor is specified fails to operate when commanded. Alarms shall be generated when the discharge air temperature sensor detects a temperature of 50 deg. F. (adj) or below for greater than 5 minutes (adj).

Alarms shall be generated when the fan indication is not indicating the correct status.

Alarms shall be generated for VFD Fault.

Alarms shall be generated when space temperature is 5 deg. F. (adj) above/below set point.

The system will be de-energized when the DDC receives a signal from the FACP system. An alarm will be initiated.

8. Fresh Air Relief:

The Heat recovery provides return/exhaust ductwork distribution sytem up to the RTU.

1.6 100% DEDICATED OUTSIDE AIR SYSTEM (GAS HEATING DX, WITH ENERGY RECOVERY) RTU-2 (DOAS) Cafeteria B01:

A. General:

The BAS Contractor shall provide a BacNet-based DDC controller and provide all required controls to perform the sequence of operation below and as indicated on the controls diagram located in M6.04

- B. The space is treated as a single control Zone; comfort conditioned and ventilated by a 100% dedicated outside air system with heat recovery wheel (HRU). DOAS/HRU that is capable of 100% return air operation for night set-back/warm-up/cool-down; the unit is capable of 100% outdoor air for economizer operation, and provide energy savings thru energy recovery wheel. The DOAS unit is also equipped with part-load dehumidification hot gas reheat. The unit is controlled by space temperature sensor for heating and cooling output to maintain a 70 deg. F (adj.) Space Temperature. The DOAS unit shall be interlocked with AC-1-1 thru AC-3. The unit is indexed for occupied/unoccupied mode of operation from the LAN gateway.
- C. Zone Optimal Start:  
The controller shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- D. Zone Unoccupied Override:  
The space sensors have a local occupancy override button with a led indication light. When the user depresses the occupancy override button, the led will light and the unit will index into the occupied mode of operation for up to 3 hours (adj). Upon the expiration of the override, the unit is placed into its scheduled mode of operation.
- E. Unoccupied mode:  
The fans are off. The outdoor, return/exhaust air dampers will remain in their full return/exhaust position with the outside and exhaust dampers closed. The DX cooling and gas heating are "off". When the space temperature falls below 60 deg. F (adj) the supply air fan will cycle on until the space temperature is above 62 deg. F. (adj). During the unoccupied mode the DX cooling and gas heat will remain off.
- F. Occupied mode:  
The fans are on and will continue to run to maintain the space temperature set point. The manufacturer's economizer will proportionately position the economizer dampers and relief air. A current switch will monitor the status of the unit fans. An alarm will be initiated whenever the fan is not in the anticipated operation.
- G. Heating mode enable:  
When the outdoor air temperature drops below 65 deg. F. (adj), the DDC controller will enable the use of the heating mode.
- H. Cooling mode enable:  
When the outdoor air temperature rises above 65 deg. F. (adj), the DDC controller will enable the use of the mechanical cooling mode.
- I. Heating mode:  
The space sensor will, through the DDC controller, index the gas furnace to maintain the space temperature set point. If the space temperature falls below the space temperature set point, the controller will index the gas furnace "on" until the space temperature rises to the space set point. If the space temperature rises above the space temperature set point, the controller will index the gas furnace "off" until the space temperature falls to the space set point. An averaging type low limit discharge air sensor shall override the control of gas furnace to prevent the discharge air from falling below 55 deg. F. (adj) regardless of space temperature.
- J. Warm-up mode:

Prior to occupancy mode, the unit will go into a warm-up mode, if the space temperature falls below 66 deg. F. (adj). The economizer dampers will go to the full recirculation position, and the gas furnace will be energized to maintain a discharge air temperature of 85 deg. F. (adj). Once the return air temperature or average space temperature returns above 70 deg. F. (adj) the warm-up mode will be deactivated and the unit will return to normal occupied mode.

K. Free cooling mode:

The DDC Controller will enable the economizer mode when the outside air temperature is less than 65F (adj); the outside air enthalpy is less than 22 BTU/h (adj) and the outside air temperature is less than the zone air temperature and proportionately position the economizer dampers. A mixed air averaging type sensor will maintain a mixed air temperature set point (55 deg. F.) (adj) by modulating the mixed air dampers.

L. Mechanical cooling mode:

When the use of mechanical cooling is selected the economizer dampers will be fixed at their minimum outdoor air position and the space temperature sensor will, through the DDC controller, stage the DX cooling to maintain the space air temperature set point. If the space air temperature rises above the space temperature set point, the controller will stage the DX cooling "on" until the space air temperature falls to the space set point. If the space air temperature falls below the space temperature set point, the controller will stage the DX cooling "off". During the mechanical cooling mode the gas furnace will remain "off".

M. Freeze Protection:

The unit will shut down and generate an alarm upon receiving a freezestat status.

N. Outside Air Damper:

The outside air damper will open anytime the unit runs and will close anytime the unit stops. The supply fan will start only after the damper status has proven the damper is open. The outside air damper will close 4sec (adj.) after the supply fan stops.

O. Heat Recovery Wheel:

The DDC controller or Manufacturer provided Heat Recovery Wheel Module shall run the heat recovery wheel for energy recovery as follows:

1. Cooling Recovery Mode:

The controller shall measure the heat wheel discharge air temperature and run the heat wheel to maintain a set point of 2°F (adj) less than the unit supply air temperature set point. The heat wheel shall run for cool recovery whenever the unit's return air temperature is 5°F (adj) or more below the outside air temperature, the unit is in a cooling mode, the economizer is off and the supply fan is on. When economizer mode is "ON" the energy recovery wheel will be commanded to stop rotating to allow air flow to go through.

2. Heating Recovery Mode:

The controller shall measure the heat wheel discharge air temperature and run the heat wheel to maintain a set point of 2°F (adj.) less than the unit supply air temperature set point. The heat wheel shall run for heat recovery whenever the unit's return air temperature is 5°F (adj) or more above the outside air temperature, the unit is in a heating mode, the economizer is off and the supply fan is on. When economizer mode is "ON" the energy recovery wheel will be commanded to stop rotating to allow air flow to go through.

3. Dehumidification:

The unit will be provided with a hot gas reheat coil which has the ability to remove the moisture out of the space after the dry bulb temperature set point has been satisfied. The hot gas



reheat coil will provide a controlled amount of reheat to the space to meet actual dehumidification requirement. When the space temperature is satisfied but the space humidity is above the humidity set point, the compressors will continue to operate and the factory controlled hot gas reheat control valves will modulate the amount of hot gas refrigerant gas passing through the reheat coil. The valve positions are controlled to provide a reset supply air temperature set point from a field supplied 0-10VDC reset signal at the BMS system.

4. Safeties and alarms:

Alarms shall be generated if any equipment for which a status feedback sensor is specified fails to operate when commanded or does not operate within the parameters (pressure, temperature, etc.) set by the Owner and/or the requirements of the engineer.

In addition to any alarms specifically described, all points shall have alarms, at the discretion of the owner and engineer, indicated on the system with priorities and presentation options (e.g. available through email, paging, etc.) configured with limits set to suit the needs of the Owner and the requirements of the engineer. Alarms shall be generated if any equipment for which a status sensor is specified fails to operate when commanded. Alarms shall be generated when the discharge air temperature sensor detects a temperature of 50 deg. F. (adj) or below for greater than 5 minutes (adj).

Alarms shall be generated when the fan indication is not indicating the correct status.

Alarms shall be generated for VFD Fault.

Alarms shall be generated when space temperature is 5 deg. F. (adj) above/below set point.

The system will be de-energized when the DDC receives a signal from the FACP system. An alarm will be initiated.

1.7 UNIT VENTILATORS UV-1-1, 1-2 Cafeteria B01

- a) Unoccupied Operation – In the unoccupied mode, the supply fan shall be indexed off, the outside air damper shall modulate closed, the return air damper shall modulate open. If the space temperature falls below the adjustable unoccupied heating setpoint, the fan shall cycle on and the outside air damper shall remain closed.
- b) Transition from Unoccupied to Occupied – When the units' transition from unoccupied to occupied mode, morning warm-up (or cool-down) and random start routines shall be activated.
- c) Morning Warm-up – When there is a call for heating and the zone temperature is two (2) degrees off setpoint, a morning warm-up sequence shall be initiated. During morning warm-up, the fan shall be turned on, the outside air damper shall remain closed and return damper shall remain open to the coil. When the space temperature comes within 2 degrees of the occupied setpoint the outside air damper shall go to the minimum position.
- d) Morning Cool-Down – When the morning cool-down is initiated the unit shall operate in the airside-economizing mode if possible, the outside air damper shall open, and the fan shall start. When the space temperature reaches the setpoint, the unit shall run in the occupied mode.
- e) Random Start – The random start routine shall be activated when electric power is applied to the controller or after receiving an occupied command from the BAS. This shall prevent the building from energizing all units at the same time. A random number generated in software shall be used to create a delayed start from 3 to 32 seconds.
- f) Occupied Operation – In the occupied mode the fan shall start and run continuously. The fan status shall be monitored via a current switch. When the status and the command do not match an alarm shall be sent the central control panel.
- g) Heating Mode – The outside air damper shall operate per ASHRAE economizer cycle II operation. The outside air damper shall provide minimum outside air for ventilation described in M6.01 drawing and Unit Ventilation Schedule. A supply air temperature sensor shall provide a low limit function and prevent the supply air temperature from falling below 60 degrees. A low limit controller will be

located on the discharge side of the heating coil. If the temperature drops below the low limit controller setting (38 degrees) the fan shall stop and the outside air damper shall close, and the central control panel shall receive an alarm.

- h) The UV-1-1, 1-2 shall be interlocked with EF-1-1. When ventilators are in occupied mode and units provide the minimum OA of 450 cfm ea. Described in M6.01 Uninit Ventilator Schedule. Refer to EF-1-1 sequence of operation.

#### 1.8 UNIT VENTILATORS UV-1-3, thru 1-5 Media Center C02/ Library C05

- i) Unoccupied Operation – In the unoccupied mode, the supply fan shall be indexed off, the outside air damper shall modulate closed, the return air damper shall modulate open. If the space temperature falls below the adjustable unoccupied heating setpoint, the fan shall cycle on and the outside air damper shall remain closed.
- j) Transition from Unoccupied to Occupied – When the units' transition from unoccupied to occupied mode, morning warm-up (or cool-down) and random start routines shall be activated.
- k) Morning Warm-up – When there is a call for heating and the zone temperature is two (2) degrees off setpoint, a morning warm-up sequence shall be initiated. During morning warm-up, the fan shall be turned on, the outside air damper shall remain closed and return damper shall remain open to the coil. When the space temperature comes within 2 degrees of the occupied setpoint the outside air damper shall go to the minimum position.
- l) Morning Cool-Down – When the morning cool-down is initiated the unit shall operate in the airside-economizing mode if possible, the return damper shall open, and the fan shall start. When the space temperature reaches the setpoint, the unit shall run in the occupied mode.
- m) Random Start – The random start routine shall be activated when electric power is applied to the controller or after receiving an occupied command from the BAS. This shall prevent the building from energizing all units at the same time. A random number generated in software shall be used to create a delayed start from 3 to 32 seconds.
- n) Occupied Operation – In the occupied mode the fan shall start and run continuously. The fan status shall be monitored via a current switch. When the status and the command do not match an alarm shall be sent the central control panel.
- o) Heating Mode – The outside air damper shall operate per ASHRAE economizer cycle II operation. The outside air damper shall provide minimum outside air for ventilation described in M6.01 drawing and Unit Ventilation Schedule. The return damper shall open to maintain the space temperature setpoint. A supply air temperature sensor shall provide a low limit function and prevent the supply air temperature from falling below 60 degrees. A low limit controller will be located on the discharge side of the heating coil. If the temperature drops below the low limit controller setting (38 degrees) the fan shall stop and the outside air damper shall close, and the central control panel shall receive an alarm.
- p) The UV-1-3, thru 1-5 shall be interlocked with EF-1-3. When ventilators are in occupied mode and units provide the minimum OA of 325 cfm ea. Described in M6.01 Unit Ventilator Schedule. Refer to EF-3 sequence of operation.

#### 1.9 UNIT VENTILATORS UV-1-6, thru 1-8 Breakout Room C09 / Art Room C10

- q) Unoccupied Operation – In the unoccupied mode, the supply fan shall be indexed off, the outside air damper shall modulate closed, the return air damper shall modulate open based space temperature. If the space temperature falls below the adjustable unoccupied heating setpoint, the fan shall cycle on and the outside air damper shall remain closed.
- r) Transition from Unoccupied to Occupied – When the units' transition from unoccupied to occupied mode, morning warm-up (or cool-down) and random start routines shall be activated.
- s) Morning Warm-up – When there is a call for heating and the zone temperature is two (2) degrees off setpoint, a morning warm-up sequence shall be initiated. During morning warm-up, the fan shall

be turned on, the outside air damper shall remain closed. When the space temperature comes within 2 degrees of the occupied setpoint the outside air damper shall go to the minimum position.

- t) Morning Cool-Down – When the morning cool-down is initiated the unit shall operate in the airside-economizing mode if possible, the return damper shall open, and the fan shall start. When the space temperature reaches the setpoint, the unit shall run in the occupied mode.
- u) Random Start – The random start routine shall be activated when electric power is applied to the controller or after receiving an occupied command from the BAS. This shall prevent the building from energizing all units at the same time. A random number generated in software shall be used to create a delayed start from 3 to 32 seconds.
- v) Occupied Operation – In the occupied mode the fan shall start and run continuously. The fan status shall be monitored via a current switch. When the status and the command do not match an alarm shall be sent the central control panel.
- w) Heating Mode – The outside air damper shall operate per ASHRAE economizer cycle II operation. The outside air damper shall provide minimum outside air for ventilation described in M6.01 drawing and Unit Ventilation Schedule. The return damper shall modulate to maintain the space temperature setpoint. A supply air temperature sensor shall provide a low limit function and prevent the supply air temperature from falling below 60 degrees. A low limit controller will be located on the discharge side of the heating coil. If the temperature drops below the low limit controller setting (38 degrees) the fan shall stop and the outside air damper shall close, and the central control panel shall receive an alarm.
- x) The UV-1-6, thru 1-8 shall be interlocked with EF-1-4. When ventilators are in occupied mode and units provide the minimum OA (UV-1-6 180 cfm, UV-1-7 & 1-8, 370 ea.) Described in M6.01 Unit Ventilator Schedule. Refer to EF-4 sequence of operation.

## 1.8 ENERGY RECOVERY VENTILATORS

- A. The ATC contractor (ATC) shall provide a Control Relay (R) & a Current Switch (CS) to monitor the status of the energy recovery ventilators. An alarm shall be generated when the status of the Fan does not meet the commanded sequence after 30 seconds.
- B. “Unoccupied” & “Warm-up” mode of operations: The energy recovery ventilator’s fans shall remain off during the “Unoccupied” mode & warm-up mode of operations and the intake/exhaust motorized dampers shall close “OFF”.
- C. “Occupied” mode: The energy recovery ventilator’s fan shall be on when the associated HVAC Equipment is in the “Occupied” mode. The ERV associated motorized intake/exhaust dampers shall open “ON” position when unit enables.

## 1.9 HEAT PUMP AC UNITS

- A. The HP/AC Monitoring Manufacturer (UM) shall provide a BACnet MS/TP communications card; all time to coordinate the integration to the BMS. The ATC contractor (ATC) shall provide the BACnet MS/TP communications wiring to the CRAC BACnet MS/TP communications board; provide all time to integrate the BACnet points.
- B. Scheduling: The HP/AC Monitoring shall be enabled (ENABLE) from the BMS
- C. Control: A Unit manufacturer Temperature (TEMP) and Humidity (RH) sensors shall monitor and control the space conditions through the unit’s own internal controls. A Liquid Detection sensor (LDS) mounted in the drip pan shall be hard-wired to shut down the HP/AC Monitoring upon detection of liquid.

- D. Monitoring and Integration: A BMS DDC Space Temperature sensor (RMT) and Humidity sensor (RMRH) shall monitor the space conditions. The BMS shall monitor the alarm status (ALARM) of the CRAC through both a hard-wired connection and BACnet integration.
- E. Operator and Graphical User Interface requirements: The Building Management System Control Diagrams and the tables below shall provide for Operator Control of the HVAC equipment through an accurate depiction of the devices within the unit, along with the I/O points, parameters and alarms shall be displayed on a customized 3-dimensional web-based graphic.

1. Input/Output Points:

HP/AC Monitoring	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
HP/AC Monitoring Enable				X	X	X	
Space Temperature (RMT)	X				X	X	TS-W
Space Humidity (RMRH)	X				X	X	RH-W
CRAC Alarm (ALARM)			X		X	X	
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)							

2. Control Parameters and Settings

HP/AC Monitoring	Parameters and Settings			
Parameter Name/Description X = Display on GUI C = Concealed A = Adjustable	AV	Trend	GUI	Initial-Setting
Setpoint and/or Parameters	A	X	C	Alarm settings
Alarm Reset	A	X	X	
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)				

3. Alarms

HP/AC Monitoring	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
Unit Alarms	BACnet	As applicable	As applicable

- F. BMS system will control Occupied and Unoccupied Modes through time schedule.

G. Occupied:

The fan shall run continuously. On a call for heating the compressor shall cycle the heating stage(s) to maintain actual setpoint. On a call for cooling the compressor shall cycle the cooling stage(s) to maintain actual setpoint. Time delays for cycling stages shall follow the heat pump manufacturer's specifications. The high and low setpoint knob limits shall be 68 degrees F and 75 degrees F (adjustable). The high and low limits do not need to be displayed at the front-end, but do need to be accessible parameters in the program.

H. Unoccupied:

Fan and compressor shall cycle to maintain the space temperature between the unoccupied heating and cooling setpoints. The unoccupied heating space setpoint shall be 60 degrees F (adjustable setpoint) and the unoccupied cooling setpoint shall be 80 degrees F (adjustable setpoint).

## 1.10 FINTUBE, RADIATORS AND CONVECTORS

- A. Scheduling and control: As identical to the associated BACnet DDC controller's schedule and Space Temperature sensor (RMT), and Heating setpoint.
- B. "Unoccupied": The Heating Control valve (FTR) shall be commanded "closed".
- C. "Unoccupied Heating": When the Space Temperature (RMT) < the "Unoccupied Heating" Setpoint (UHSP) the Heating Control valve (FTR) shall be commanded "open". When the Space Temperature (RMT) > the "Unoccupied Heating" Setpoint (UHSP) hysteresis, the Heating Control valve (FTR) shall be commanded "closed".
- D. "Occupied": When the Space Temperature (RMT) < the "Occupied Heating" Setpoint (HSP) the Heating Control valve (FTR) shall be commanded "open". When the Space Temperature (RMT) > the "Occupied Heating" Setpoint (HSP) hysteresis, the Heating Control valve (FTR) shall be commanded "closed".
- E. Operator and Graphical User Interface requirements: The Building Management System Control Diagrams and the tables below shall provide for Operator Control of the HVAC equipment through an accurate depiction of the devices within the unit, along with the I/O points, parameters and alarms shall be displayed on a customized 3-dimensional web-based graphic.

### 1. Input/Output Points:

Fintube Radiators and Convectors	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Space Temperature (RMT)	X				X	X	TS-W
Heating Control valve (FTR)				X	X	X	CV
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)							

### 2. Control Parameters and Settings

Fintube Radiators and Convectors	Parameters and Settings			
Parameter Name/Description X = Display on GUI C = Concealed A = Adjustable	AV	Trend	GUI	Initial-Setting
"Unoccupied" Space Heating Setpoint (UHSP)	X		X	60 °F
"Occupied" Space Heating Setpoint (HSP)	X		X	70 °F
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)				

### 3. Alarms

Fintube Radiators and Convectors	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
High Air Temperature	RMT		#AT > #HSP+5 °F
Low Air Temperature	RMT		#AT -5 °F < #HSP

## 1.11 CABINET/UNIT HEATER – HOT WATER VALVE

- A. Control: The Building Management System contractor (BMSC) shall provide, install, and wire an electric Thermostat (TC) with setpoint (adj.); an Hot Water pipe aquastat (AQS); provide and wire a Normally Open - 2 position Hot Water Control valve (HWV). The Space Heating Setpoint (LHSP) is initially set at 70°F (adj.); the Aquastat switch (AQS) shall be set at 95°F (adj.). When the temperature is less than the Thermostat (TC) Heating Setpoint (LHSP), the

Hot Water Control valve (HWV) shall "open". When the pipe temperature is more than the Aquastat (AQS) setpoint, the Cabinet/Unit Heater's fan shall start. When the temperature is more than the Thermostat (TC) Heating Setpoint (LHSP) hysteresis, the Cabinet/Unit heater's Fan shall stop, the Hot Water Control valve (HWV) shall "close".

- F. Cabinet Unit Heater with Outside Air Intake. The intake damper will be motorized set for the outside air requirements shown Hot Water Cabinet Heater and Ventilation Schedule located in drawing. M6.01. When the cabinet heater is in "OFF" position during unoccupied mode, the intake damper will be commanded to be in "CLOSE" position

#### 1.12 KITCHEN EXHAUST. EF-1-1

EF-1-1: Exhaust fan is a dual speed fan that provides kitchen general exhaust and unit ventilators fresh air relief. Exhaust fan shall be interlocked with UV-1-1 & UV-1-2 and Kitchen Hood Make up Air Unit.

- A. "Occupied": When the UV-1-1 is enables, the exhaust fan shall run at single speed to provide kitchen general exhaust and UV fresh air relief. When UV-1-1 & UV-1-2 enable the exhaust fan shall be commanded to run at second speed to provide kitchen general exhaust and UV-1-1 & UV-1-2 fresh air relief. When UV-1-1 & UV-1-2 disables, the exhaust fan shall be commanded to run at single speed to provide kitchen general exhaust.
- B. "Unoccupied": When the UV-1-1, UV-1-2 and Kitchen Hood Make Up Units disable, the EF-1-1 shall be commanded turn "OFF" based on an adjustable timer.

#### 1.13 EXHAUST FAN. EF-1-2 Utility Closet B04

EF-1-2: Exhaust shall run continuolsly.

- A. The fan shall be commanded to turn off thru switch located in utility closet B04

#### 1.14 EXHAUST FAN. EF-1-3 Media Center C02 & Library C05

EF-1-3: Exhaust fan provides unit ventilators fresh air relief. Exhaust fan shall be interlocked with UV-1-3 thru 1-5.

- A. "Occupied": When the UV-1-3 thru 1-5 enable, the exhaust fan shall run to provide UV fresh air relief.
- B. "Unoccupied": When the UV-1-3 thru 1-5 Units disable, the EF-1-3 shall be commanded turn "OFF".

1.15 EXHAUST FAN. EF-1-4 Art Room 06/ Break out Room C09

EF-1-4: Exhaust fan provides unit ventilators fresh air relief. Exhaust fan shall be interlocked with UV-1-6 thru 1-8.

- A. "Occupied": When the UV-1-6 thru 1-8 enable, the exhaust fan shall run to provide UV fresh air relief.
- B. "Unoccupied": When the UV-1-6 thru 1-8 Units disable, the EF-1-4 shall be commanded turn "OFF".

1.16 EXHAUST FAN. EF-1-5 Kiln Room / Art Storage C11

- A. EF-1-5: Unit shall be controlled by a wall mounted thermostat. When the space temperature exceeds the set point, a signal shall be sent to start the exhaust fan. Once the space is satisfied, a signal shall be sent to stop the exhaust fan.

1.17 EXHAUST FAN. EF-2-1 SGI A104

EF-2-1: Exhaust fan provides existing AHU-2 fresh air relief. Exhaust fan shall be interlocked with existing AHU-2.

- A. "Occupied": When the existing AHU-2 enable, the exhaust fan shall run to provide fresh air relief.
- B. "Unoccupied": When the the existing AHU-2 disable, the EF-2-1 shall be commanded turn "OFF".

1.18 ELEVATOR SHAFT EXHAUST FANS EF-R-1

- A. EF-R1: Unit shall be controlled by a wall mounted thermostat. When the space temperature exceeds the set point, a signal shall be sent to start the exhaust fan. Once the space is satisfied, a signal shall be sent to stop the exhaust fan.

1.19 GLOBAL OUTSIDE AIR TEMPERATURE, HUMIDITY & CO2:

- A. The ATC contractor (ATC) shall provide, install & wire an Outside Air temperature & humidity sensors with weather/sunshields enclosure on the northern exposure of the building.

- B. Operator & Graphical User Interface requirements: The Building Management System Control Diagrams and the tables below shall provide for Operator Control of the HVAC equipment through an accurate depiction of the devices within the unit, along with the I/O points, parameters and alarms shall be displayed on a customized 3-dimensional web-based graphic.

Outside Air Temp, Humidity & CO <sub>2</sub>	I/O Points				Software Point					
Point Name/Description/Legend X = DDC I/O L=Local Control A = Adjustable O = Override	AI	AO	BI	BO	AV	BV	Sched-	Trend	Alarm	GUI
										Initial-Alarm Setting

Outside Air Temperature (OAT)	X				X			X		X	
Outside Air Humidity (OAH)	X				X			X		X	
Outside Air CO2 Levels (OACO2)	X				X			X		X	
Highest Values (Past24 hours)					X					X	
Lowest Values (Past 24 Hours)					X					X	
Calculated ° Days (Monthly)					X			X		X	Calc.
Calculated Enthalpy (btu/lbs.)					X			X		X	Calc.

#### 1.20 GRAPHICAL USER INTERFACE (GUI)

- A. Graphical User Interface – Workstation: The ATC contractor (ATC) shall provide a TCP/IP connected Workstation with the ability to read, adjust & override the various parameters for system control; provide each of the DDC controlled equipment with graphics with a minimum of the complete I/O point listing, their associated setpoints & any other variable for the adjustment & operation of the system.
- B. Graphical User Interface - Liquid Crystal Display (LCD): The ATC contractor (ATC) shall provide a Panel Mounted connected Liquid Crystal Display the ability to read, adjust & override the various parameters for system control. Provide each of the DDC controlled equipment with graphics with a minimum of the complete I/O point listing, their associated setpoints & any other variable for the adjustment & operation of the system. Demonstrate the operation of the system to the owner prior to acceptance of the system.
- C. Graphical User Interface Demonstration: Demonstrate the Graphics, trending & communications setup to the owner prior to acceptance of the system.
- D. Alarm Notification: The system shall notify the owner of an alarming condition via a Visual Alerts & Audible sounds locally at the GUI. If connected via a TCP/IP connection, an e-mail sent depending on user configuration. Any maintenance worker shall be capable of interrogating the alarm using the Laptop workstation browsers (via. the internet)

#### 1.21 COMMISSIONING

- A. Startup: The ATC system shall be set up & checked by factory trained competent technicians skilled in the setting & adjustment of the ATC equipment used in this project. The technicians are to be experienced in the type of HVAC systems associated with this project.
- B. Demonstration: At the completion of the commissioning, The ATC contractor (ATC) shall: demonstrate the sequence of operations for each system to the Architect or representative.

#### 1.22 OWNER TRAINING

- A. The ATC contractor (ATC) shall provide 16 hours of training to the Owner's personnel. The Training is to include the operation & maintenance of the control system. Training shall be provided after the system has been commissioned & demonstrated to the Architect or his representative.



2 PRODUCTS (Not Applicable)

3 EXECUTION (Not Applicable)

END OF SECTION 230993



## SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Above ground hot-water heating piping.
  - 2. Air-vent piping.
  - 3. Safety-valve-inlet and -outlet piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Hot-Water Heating Piping: 175 psig at 250 deg F.
  - 2. Air-Vent Piping: 200 deg F.
  - 3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. All types of piping.
- B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Welding certificates.
- D. Qualification Data: For Installer.
- E. Field quality-control test reports.

- F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
- G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## 1.6 EXTRA MATERIALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
- B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- E. Wrought-Copper Unions: ASME B16.22.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Class 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Class 250 or 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Class 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  1. Material Group: 1.1.
  2. End Connections: Butt welding.
  3. Facings: Raised face.
- H. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 250, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
    - f. Or Approved Equal.
  - 3. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - d. Or Approved Equal.
  - 3. Factory-fabricated companion-flange assembly, for 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
  - e. Or Approved Equal.
3. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
4. Separate companion flanges and steel bolts and nuts shall have 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Calpico, Inc.
  - b. Lochinvar Corporation.
  - c. Or Approved Equal.
3. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

G. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Perfection Corporation; a subsidiary of American Meter Company.
  - b. Sioux Chief Manufacturing Company, Inc.
  - c. Or Approved Equal.
3. Electroplated steel or ductile iron nipple with inert and noncorrosive, thermoplastic lining; plain, or threaded; and 300-psig (2070-kPa) minimum working pressure at 230 deg F (110 deg C). Victaulic Style 47.

## 2.5 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 15 Section "General-duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors.
- C. Ametal® Brass Calibrated-Orifice, Balancing Valves:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Victaulic/Tour & Andersson Series 786, 787 or 78K.
    - c. Or Approved Equal.
  - 4. Body: Ametal® brass copper alloy, y-pattern, globe type.
  - 5. Seat: Ametal® brass copper alloy.
  - 6. End Connections: Threaded or soldered.
  - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 8. Handle Style: Multiple-turn digital readout handwheel with memory stop to retain set position.
  - 9. CWP Rating: Minimum 200 psig (860 kPa).
  - 10. Maximum Operating Temperature: 250 deg F (121 deg C).
  - 11. Coil Components: Install Series 78U union port fitting and Series 78Y strainer/ball valve combination to complete terminal hookup at coil outlet.
  - 12. Differential Pressure Controller: Install Series 793 differential pressure controller to stabilize differential pressure and ensure stable and accurate modulating control. Ametal® brass copper alloy body, bonnet, cone and spindles, threaded ends only.
- D. Ductile-Iron, Calibrated-Orifice, Balancing Valves:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Victaulic/Tour & Andersson Series 788 and 789
    - c. Or Approved Equal.
  - 4. Body: Ductile iron body, globe pattern.
  - 5. Stem Seals: EPDM O-rings.
  - 6. Seat: Ductile iron.
  - 7. End Connections: Flanged.
  - 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.



9. Handle Style: Multiple-turn digital readout handwheel with memory stop to retain set position.
10. CWP Rating: Minimum 200 psig (860 kPa).
11. Maximum Operating Temperature: 250 deg F (121 deg C).
12. Differential Pressure Controller: Install Series 794 differential pressure controller with 2-1/2" through 4" valves to stabilize differential pressure and ensure stable and accurate modulating control. Ductile iron body, Ametal® brass copper alloy bonnet, cone and spindles, flanged ends only.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - g. Or Approved Equal.
4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Low inlet-pressure check valve.
10. Inlet Strainer: Removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

- g. Or Approved Equal.
- 4. Body: Bronze or brass.
- 5. Disc: Glass and carbon-filled PTFE.
- 6. Seat: Brass.
- 7. Stem Seals: EPDM O-rings.
- 8. Diaphragm: EPT.
- 9. Wetted, Internal Work Parts: Brass and rubber.
- 10. Inlet Strainer: Removable without system shutdown.
- 11. Valve Seat and Stem: Noncorrosive.
- 12. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
  - a. Flow Design Inc.
  - b. Griswold Controls.
  - c. Or Approved Equal.
- 4. Body: Brass or ferrous metal.
- 5. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
- 6. Combination Assemblies: Include bronze or brass-alloy ball valve.
- 7. Identification Tag: Marked with zone identification, valve number, and flow rate.
- 8. Size: Same as pipe in which installed.
- 9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
- 10. Minimum CWP Rating: 175 psig.
- 11. Maximum Operating Temperature: 200 deg F (93 deg C).

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 3 (DN 75) and smaller, shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
- B. Hot-water heating piping, aboveground, NPS 4 (DN 100) and larger, shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

- C. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
  - 2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.
- D. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

### 3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install balancing valves at each branch connection to return main.
- C. Install globe type balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.

- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using [mechanically formed] tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 15 Section "Valves."
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
- T. Identify piping as specified in Division 23 Section "Mechanical Identification."

### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
- C. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
  2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
  3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
  4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
  5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
  6. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
  7. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
  8. NPS 6 (DN 150): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
  2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
  3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
  4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
  5. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
  6. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
- F. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages."

### 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  4. Set temperature controls so all coils are calling for full flow.
  5. Inspect and set operating temperatures of hydronic equipment, such as boilers, to specified values.
  6. Verify lubrication of motors and bearings.

END OF SECTION 232113





## SECTION 232116 - HYDRONIC PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
  - 1. Above ground hot-water heating piping.
  - 2. Air-vent piping.
  - 3. Safety-valve-inlet and -outlet piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 2. Air-control devices.
  - 3. Hydronic specialties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

#### 1.6 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
  - 1. Hot-Water Heating Piping: 175 psig at 250 deg F.
  - 2. Air-Vent Piping: 200 deg F.
  - 3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

### 2.2 VALVES

- A. Gate, Globe, Check and Ball Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Sections.
- C. General: Provide factory-fabricated hydronic specialties recommended by manufacturer for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Owner's Representative to comply with installation requirements. Provide sizes and connections which properly mate with pipe, tube and equipment connections.
- D. Balancing Valves:
  - 1. Where the Drawings indicate a balancing valve in the water piping, provide a 150 psig diaphragm packless type combination shut-off and balancing valve with the diaphragm attached to the valve stem. Valve shall be complete with a locking mechanism that can be set at a balance point, so that the valve may be opened and closed, but not opened beyond the pre-set balance point. Valve shall be furnished with an indicator, marked to show 0% to 100% of flow. Valve body shall be of cast iron or semi-steel and shall be painted with a rust-preventive epoxy or equal coating.
  - 2. Manufacturers: Subject to compliance with requirements, manufacturers offering balancing valves which may be incorporated in the work include, but are not limited to, the following:
    - a. American Air Filter Co.
    - b. Bell & Gossett ITT; Fluid Handling Div.
    - c. Danfoss, Inc.
    - d. Griswold Controls
    - e. Milwaukee Valve Co., Inc.
    - f. Spirax Sarco.
    - g. Taco, Inc.
    - h. Or Approved Equal.
- E. Balancing Cocks:

1. Provide balance cocks as shown on the Drawings, of one of the following types:
  - a. Threaded Ends 2" and Smaller" Class 250, bronze body, bronze plug, screwdriver operated, straight or angle pattern.
  - b. Soldered Ends 2" or Smaller: Class 250, bronze body, bronze plug, screwdriver operated, straight or angled pattern.
2. Manufacturers: Subject to compliance with requirements, manufacturers offering balance cocks which may be incorporated in the work include, but are not limited to the following:
  - a. American Air Filter Co.
  - b. Bell & Gossett ITT; Fluid Handling Div.
  - c. Danfoss, Inc.
  - d. Griswold Controls
  - e. Milwaukee Valve Co., Inc.
  - f. Spirax Sarco.
  - g. Taco, Inc.
  - h. Or Approved Equal.

F. Flow Control Valves:

1. Provide flow control valves pressure rated for 250 psi, containing lift check assembly which will automatically open by means of pump flow pressure, and automatically close when pump is not operating. Pressure with means to manually open in case of pump failure.
  - a. Threaded Ends 2-1/2" and Smaller: Cast-iron body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
  - b. Soldered Ends 4" and Smaller: Cast-bronze body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
  - c. Flanged Ends 2-1/2" and Larger: Cast-iron body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
2. Manufacturers: Subject to compliance with requirements, manufacturers offering flow control valves which may be incorporated in the work include, but are not limited to, the following:
  - a. Armstrong Pumps, Inc.
  - b. Bell & Gossett ITT; Fluid Handling Div.
  - c. Dunham-Bush, Inc.
  - d. Taco, Inc.
  - e. Or Approved Equal.

G. Water Relief Valves:

1. Provide water relief valves as indicated on the Drawings, of size and capacity for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
  - a. Iron body with non-ferrous internal parts, ASME rated, gradually relieving not "pop" type.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering water relief valves which may be incorporated in the work include, but are not limited to, the following:

- a. Amtrol, Inc.
- b. Bell & Gossett ITT; Fluid Handling Div.
- c. Spirax Sarco.
- d. Watts Regulator Co.
- e. Or Approved Equal.

H. Pressure Reducing Valves:

1. Where shown on the Drawings, provide in the make-up water supply line, an iron body pressure reducing valve with brass internal parts. Reducing valve shall be provided with a strainer and a check valve to prevent back flow of water when city water pressure is less than the system pressure. Valve setting shall be as indicated on the Drawings.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:

- a. Amtrol, Inc.
- b. Armstrong Pumps, Inc.
- c. Bell & Gossett ITT; Fluid Handling Div.
- d. Taco, Inc.
- e. Or Approved Equal.

## 2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:

- a. Amtrol, Inc.
- b. Armstrong Pumps, Inc.
- c. Bell & Gossett ITT; Fluid Handling Div.
- d. Taco, Inc.
- e. Or Approved Equal.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8 (DN 6).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett ITT; Fluid Handling Div.
  - d. Taco, Inc.
  - e. Or Approved Equal.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/4 (DN 8).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Expansion Tanks:

1. Furnish and install as shown on the drawings, bladder type expansion tanks. Tanks shall be air pre-charged to the initial fill pressure of the system. It shall be suitable for a maximum working pressure of 250 psi. Anchor tank to prevent lateral or seismic movement.
2. Tanks shall be furnished with ASME stamp and certification papers.
3. Tanks shall have a sealed in elastomer diaphragm suitable for an operating temperature of 240°F.
4. Provide full line size lock-shield gate valve. Lock in open position.

D. Tangential-Type Air Separators:

1. Furnish and install external air separation devices consisting of air separator with strainer, 250 psi working pressure, and float vent.
2. A blow-down connection shall be provided to facilitate routine cleaning of the unit.
3. The air separator shall be Taco, Armstrong, Bell & Gossett, or Sarco. In-Line Air Separators:

## 2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 60-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 250 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 250 psig.

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig (5170 kPa).

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Class 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).  
Maximum Operating Temperature: 250 deg F (121 deg C).

## PART 3 - EXECUTION

### 3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION 232116





## SECTION 232300 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping used for air conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat Pump Applications: 535 psig.
  - 3. Hot Gas and Liquid Lines: 535 psig.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Thermostatic expansion valves.
  - 2. Solenoid valves.
  - 3. Hot gas bypass valves.
  - 4. Filter dryers.
  - 5. Strainers.
  - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
  - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between

compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

- C. Welding certificates.
- D. Field quality control test reports.
- E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

#### 1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

#### 1.7 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section, "Roof Accessories."

### PART 2 - PRODUCTS

#### 2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

#### 2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight through or angle pattern.
  - 2. Diaphragm: Phosphor bronze and stainless steel with stainless steel spring.

3. Operator: Rising stem and hand wheel.
  4. Seat: Nylon.
  5. End Connections: Socket, union, or flanged.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 275 deg F.
- B. Packed Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
  2. Packing: Molded stem, back seating, and replaceable under pressure.
  3. Operator: Rising stem.
  4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
  5. Seal Cap: Forged-brass or valox hex cap.
  6. End Connections: Socket, union, threaded, or flanged.
  7. Working Pressure Rating: 500 psig.
  8. Maximum Operating Temperature: 275 deg F.
- C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
  2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
  3. Piston: Removable polytetrafluoroethylene seat.
  4. Closing Spring: Stainless steel.
  5. Manual Opening Stem: Seal cap, plated steel stem, and graphite seal.
  6. End Connections: Socket, union, threaded, or flanged.
  7. Maximum Opening Pressure: 0.50 psig.
  8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 275 deg F.
- D. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
  2. Core: Removable ball-type check valve with stainless steel spring.

3. Seat: Polytetrafluoroethylene.
  4. End Connections: Copper spring.
  5. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
  2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  3. Seat: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
  6. Working Pressure Rating: 400 psig.
  7. Maximum Operating Temperature: 240 deg F.
  8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Seat Disc: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Working Pressure Rating: 400 psig.
  6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  5. Suction Temperature: 40 deg F.
  6. Superheat: Adjustable.

7. Reverse-flow option (for heat pump applications).
  8. End Connections: Socket, flare, or threaded union.
  9. Working Pressure Rating: 700 psig.
- H. Hot Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  5. Seat: Polytetrafluoroethylene.
  6. Equalizer: Internal.
  7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
  8. End Connections: Socket.
  9. Throttling Range: Maximum 5 psig.
  10. Working Pressure Rating: 500 psig.
  11. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
  2. Screen: 100-mesh stainless steel.
  3. End Connections: Socket or flare.
  4. Working Pressure Rating: 500 psig.
  5. Maximum Operating Temperature: 275 deg F.
- J. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
  2. Drain Plug: Brass hex plug.
  3. Screen: 100-mesh monel.
  4. End Connections: Socket or flare.

5. Working Pressure Rating: 500 psig.
  6. Maximum Operating Temperature: 275 deg F.
- K. Moisture/Liquid Indicators:
1. Body: Forged brass.
  2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  3. Indicator: Color coded to show moisture content in ppm.
  4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  5. End Connections: Socket or flare.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 240 deg F.
- L. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted steel shell with ductile iron cover, stainless steel screws, and neoprene gaskets.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
  3. Desiccant Media: Activated alumina.
  4. Designed for reverse flow (for heat pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig.
  8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 240 deg F.
- M. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted steel shell.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
  3. Desiccant Media: Activated alumina.
  4. Designed for reverse flow (for heat pump applications).

5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

N. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

O. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

P. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

## 2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atofina Chemicals, Inc.

2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

### PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot Gas and Liquid Lines and Suction Lines for Heat Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Safety Relief Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

#### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  1. Install valve so diaphragm case is warmer than bulb.
  2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  3. If external equalizer lines are required, make connection where it will reflect suction line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief valve discharge line to outside according to ASHRAE 15.



- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
  - 1. Solenoid valves.
  - 2. Thermostatic expansion valves.
  - 3. Hot gas bypass valves.
  - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping adjacent to machines to allow service and maintenance.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Refer to Division 23 Sections, "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or

panels as specified in Division 08 Section, "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Division 23 Section, "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section, "Sleeves and Sleeve Seals for HVAC Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section, "Sleeves and Sleeve Seals for HVAC Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section, "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure. Test piping in accordance with the Mechanical Code of New York State.
  - 3. Test high and low pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.

- b. System shall maintain test pressure at the manifold gage throughout duration of test.
- c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  - 4. Charge system with a new filter-dryer core in charging line.

### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set point temperature of air conditioning or chilled water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

## SECTION 233113 – METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:
  - 1. Rectangular ducts and fittings.
  - 2. Single-wall round spiral-seam ducts and formed fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
  - 6. Seismic-restraint devices.
- B. Related Sections include the following:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVACR" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 DEFINITIONS

- A. NUSIG: National Uniform Seismic Installation Guidelines.

#### 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### 1.5 SUBMITTALS

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  2. Duct layout indicating sizes and pressure classes.
  3. Elevations of top and bottom of ducts.
  4. Dimensions of main duct runs from building grid lines.
  5. Fittings.
  6. Reinforcement and spacing.
  7. Seam and joint construction.
  8. Penetrations through fire-rated and other partitions.
  9. Equipment installation based on equipment being used on Project.
  10. Duct accessories, including access doors and panels.
  11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Ceiling suspension assembly members.
  2. Other systems installed in same space as ducts.
  3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
  4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- C. Welding certificates.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:
1. International Mechanical Code IMC 2018.
- C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

## 2.5 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.



- E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

## 2.6 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
  - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  - 3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

## 2.7 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by [an evaluation service member of the ICC Evaluation Service] [an agency acceptable to authorities having jurisdiction].
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for

attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

- C. Restraint Cables: [ASTM A 603, galvanized] [ASTM A 492, stainless]-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: [Steel tube or steel slotted-support-system sleeve with internally bolted connections] [Reinforcing steel angle clamped] to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.8 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
    - d. McGrill AirFlow LLC.
    - e. Or Approved Equal.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Lockformer.
    - c. McGrill AirFlow LLC.
    - d. SEMCO LLC
    - e. Or Approved Equal.
  - 2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
  - 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of non-braced panel area unless ducts are lined.

## 2.9 ROUND DUCT AND FITTING FABRICATION (WHERE INDICATED ON DRAWINGS)

- A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate exhaust air ducts of aluminum according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

- 1. Manufacturers:

- a. McGill AirFlow Corporation.
    - b. SEMCO Incorporated.
    - c. Ductmate Industries, Inc.
    - d. Spiral Manufacturing Co.
    - e. Or Approved Equal.

- B. Duct Joints:

- 1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  - 2. Ducts 21 to 72 Inches (535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  - 3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

- a. Manufacturers:

- 1) Ductmate Industries, Inc.
      - 2) Lindab Inc.
      - 3) SEMCO Incorporated.
      - 4) McGill AirFlow Corporation.
      - 5) Or Approved Equal.

- C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

- D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

- E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

- 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):

- a. Ducts 3 to 36 Inches (75 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
  - b. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
- 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2500 Pa):
  - a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
  - b. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
- 4. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 5. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 6. Die-Formed Elbows for Sizes through 8 Inches (200 mm) in Diameter and All Pressures 0.040 inch (1.0 mm) thick with 2-piece welded construction.
- 7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- 8. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

## PART 3 - EXECUTION

### 3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  - 1. Return Ducts (Negative Pressure): 2 inch wg.
  - 2. Exhaust Ducts (Negative Pressure): 2-inch wg.
- B. All ducts shall be galvanized steel except exhaust air duct for chemical fume hood shall be aluminum construction.

### 3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.
- C. Install ducts with fewest possible joints.

- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."
- O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a

compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

### 3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
  - 1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.
- B. Seal ducts before external insulation is applied.

### 3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
  - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
  - 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative

pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

### 3.7 CLEANING NEW SYSTEMS

- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
  1. Create other openings to comply with duct standards.
  2. Disconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
  1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
- E. Mechanical Cleaning Methodology:
  1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct accessories.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 233113



## SECTION 233300 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Control dampers.
  - 3. Fire dampers.
  - 4. Flange connectors.
  - 5. Turning vanes.
  - 6. Flexible connectors.
  - 7. Flexible ducts.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

### 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Standard leakage rating, with linkage outside airstream.
  - 2. Suitable for horizontal or vertical applications.
  - 3. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 4. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  - 5. Blade Axles: Galvanized steel.
  - 6. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 7. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:

1. Comply with AMCA 500-D testing for damper rating.
2. Low-leakage rating with linkage outside airstream and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:
  - a. Angle shaped.
  - b. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Blade Seals: Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

## 2.4 FIRE DAMPERS

- A. Type: Static; rated and labeled according to UL 555 by an NRTL.
- B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- C. Fire Rating: 1-1/2 hours.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  1. Minimum Thickness: 0.39 inch (9.9 mm) thick, as indicated, and of length to suit application.
  2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.

- G. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

## 2.5 FLANGE CONNECTORS

- A. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

## 2.6 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply and return systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers according to UL listing.
- G. Install flexible connectors to connect ducts to equipment.
- H. Connect terminal units to supply ducts with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- I. Connect flexible ducts to metal ducts with [adhesive plus sheet metal screws.
- J. Install duct test holes where required for testing and balancing purposes.
- K. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
  4. Inspect turning vanes for proper and secure installation.
  5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300



## SECTION 233416 – CENTRIFUGAL HVAC FANS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exhaust Fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. AMCA compliance is an optional requirement and not necessarily available from all manufacturers.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

## 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 CENTRIFUGAL FANS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawings or approved equal:
  - 1. Greenheck
  - 2. Loren Cook
  - 3. CaptiveAir Systems
  - 4. Or Approved Equal



D. Exhaust Fans – Model G:

1. Model G Roof exhaust fans shall be centrifugal direct drive type. The fan housing and shroud shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.
2. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.
3. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.
4. A disconnect switch shall be factory installed and wired from the motor compartment for ease of electrical wiring. Galvanized rigid wire protects the fan's discharge from birds or small objects.
5. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
6. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
7. Fan shall be Model G as manufactured by Greenheck or approved equal.

E. Exhaust Fans – Model CSP:

1. Duct mounted exhaust air fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of heavy-gauge galvanized steel. The housing interior shall be lined with 0.5 in. acoustical insulation.
2. The outlet duct collar shall include an aluminum backdraft damper and shall be adaptable for horizontal or vertical discharge.
3. The access for wiring shall be external.
4. The motor disconnect shall be internal and of the plug-in type.
5. The motor shall be mounted on vibration isolators.
6. The fan wheel shall be of the forward-curved centrifugal type and dynamically balanced.
7. All fans shall bear the AMCA Certified Ratings program AMCA Air Performance seal and shall be UL/cUL Listed.
8. Fans shall be Model CSP as manufactured by Greenheck or approved equal.

F. Kitchen Hood Exhaust Fan:

1. Description:

Fan shall be aluminized and galvanized steel, roof mounted, belt and or direct driven, centrifugal up blast restaurant utility exhaust ventilator.

2. Application:

USBI-RM centrifugal up blast restaurant utility exhaust ventilators are engineered to discharge grease laden vapors, fumes and other contaminants vertically away from the building. Model USBI-RM is specifically intended for high temperature and heavy grease applications.

3. Certifications:

All models shall be ETL Listed and comply with UL705 (electrical), UL762, and ULC-S645 Standards and CSA Std C22.2, No 113. Fan shall bear the AMCA certified ratings seal for sound and air performance.

4. Housing:

The fan shall be constructed of aluminized and galvanized steel. Fan scroll shall be continuously sealed with a listed intumescent to prevent grease leakage. The fan scroll shall be tack welded and have a 2" fully welded drain to prevent grease leakage and blockage of the drain.

5. Base:

The base shall be constructed of galvanized steel for improved rigidity. Bolt patterns shall be provided in the base to allow connection to a pollution control unit.

6. Wheel:

The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel shall be heavy gauge welded aluminum. In the event that balancing weights are required they shall be riveted or welded to the blades or wheel. The wheel inlet shall overlap the fan inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with set screws.

7. Motor & Motor Compartment:

Motors shall be heavy duty ball bearing type, mounted out of the airstream and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge steel. The motor compartment shall be cooled by outside air drawn through louvers in the motor cover. The motor compartment shall be completely removable to provide unobstructed access to the motor and drives. The motor cover assembly shall have wing bolts to secure the assembly to the housing.

8. Shaft and Bearings:

Shafts shall be precision ground and polished. Heavy duty, per-lubricated bearings shall be selected for a minimum life (L10) life in excess of 200,000 hours of operation at cataloged operating speed. They shall be designed and individually tested specifically for use in air handling applications.

9. Belts & Drives:

Belts shall be oil and heat resistant, non-static type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Drives shall be sized for a minimum of 150% of the installed motor horsepower. Fan operating speed shall be factory set using adjustable pitch motor pulleys; motors over 2 HP will come standard with double groove pulleys.

10. Grease Spout:

The 2" grease drain is fully welded in the discharge scroll, a removable grease trough is attached to the scroll to collect grease.

11. Safety Disconnect Switch:

A safety disconnect switch shall be standard on all USBI-RM units with open drip proof motors. Switches shall be installed in a NEMA3R enclosure and mounted to exterior of the fan for easy access.

12. Fan shall be as manufactured by CaptiveAire Systems or Approved Equal.

## 2.2 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install centrifugal fans level and plumb.
- B. Support suspended units from structure using threaded steel rods and vibration isolators.
- C. Install units with clearances for service and maintenance.
- D. Label fans according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."

- B. Install ducts adjacent to fans to allow service and maintenance.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
  - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 233416

## SECTION 233533 - LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Listed kitchen hood exhaust grease ducts.
  - 2. Access doors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for listed grease ducts.
- B. Shop Drawings: For listed grease ducts.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Detail fabrication and assembly of hangers and seismic restraints.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in listed grease ducts and field-fabricated grease ducts.

## PART 2 - PRODUCTS

### 2.1 LISTED GREASE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide a comparable product by one of the following:
1. Captive-Aire Systems
  2. Ductmate
  3. Or Approved Equal
- B. Furnish and install double-wall, factory-built grease duct for use with type I kitchen hoods, which shall conform to the requirements of NFPA 96. Duct products shall be ETL listed to UL-1978 and UL-2221 for venting air and grease vapors from commercial cooking operation. Provide "Captive-Aire" model DW-3Z (or Approved Equal) to be used for grease duct applications and installed in accordance with these instructions and NFPA 96; standard for ventilation control and fire protection of commercial cooking operations. Double wall grease ducts shall be listed for a continuous internal temperature of 500°F and intermittent temperatures of 2000°F.
- C. Furnish and install single wall, factory-built grease duct for use with type II kitchen hoods, which shall conform to the requirements of NFPA 96. Provide "Captive-Aire" model DW or Approved Equal.
- D. Duct sections shall be constructed of an inner duct wall and an outer wall with 3" of insulation in between. The inner duct wall shall be constructed of .036 inch thick, 430 type stainless steel. The outer wall shall be constructed of stainless steel at a minimum of .024 inch thickness. The duct shall include layers of Super Wool 607 plus insulation between the inner and outer wall. Grease duct joints shall be held together by means of formed V clamps and sealed with 3M fire barrier 2000+. The duct wall assembly shall be tested and listed at zero (0") inch clearance according to classifications.
- E. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at 1500 deg F minimum.
- F. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.
- G. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.
- H. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.
1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
  2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.
  3. Provide duct saddle supports spaced max. 5'-0" and at all changed in direction
- I. Comply with ASTM E 2336.

- J. Factory Tests: Test and inspect fire resistance of grease duct system according to ASTM E 2336.

1. Allow consultant two days' minimum notification before test is performed.

## 2.2 ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Durodyne
2. Ductmate
3. Or Approved Equal.

- B. Description: Factory-fabricated, -listed, and -labeled, double-wall personnel and maintenance access doors tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

1. Construction: 0.0625 inch ASTM A 666, Type 304 stainless-steel inner shell and stainless-steel outer cover with two handles.
2. Fasteners: Stainless-steel bolts and wing nuts.

- a. Ensure that bolts do not penetrate interior of duct space.

3. Maintenance Access Door Dimensions: 7 x 7 inches.
4. Personnel Access Door Dimensions: 22 x 20 inches.
5. Door Label: Mark door with uppercase lettering as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Comply with requirements in Section 077200 "Roof Accessories."
- B. Coordinate connections to kitchen exhaust hoods with requirements in Section 233813 "Commercial-Kitchen Hoods."
- C. Coordinate connections to exhaust.
- D. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211 and UL 2221, whichever is most stringent.

- E. Install airtight personnel and maintenance access doors.
- F. Seal between sections of grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- G. Connections: Make grease duct connections according to the International Mechanical Code.
  - 1. Grease duct to exhaust fan connections: Connect grease ducts to inlet side of fan using flanges, gaskets, and bolts.
  - 2. Grease duct to hood connections:
    - a. Make grease duct to hood joints connections using internal or external continuously welded or brazed joints.
    - b. Make watertight grease duct to hood joints connections using flanges, gaskets, and bolts.
- H. Support ducts at intervals recommended by manufacturer to support weight of ducts and accessories, without applying loading on kitchen hoods.
  - 1. Securely attach supports and bracing to structure.
- I. Grease Duct Enclosures: Comply with requirements of the International Building Code and ASTM E 2336.
- J. Coordinate fire-rated enclosure construction with Section 092116.23 "Gypsum Board Shaft Wall Assemblies."
- K. Repair damage to adjacent materials caused by listed kitchen ventilation system exhaust ducts installation.

### 3.3 FIELD QUALITY CONTROL

- A. Perform air leakage test before concealment of any portion of the grease duct system.
  - 1. Notify Owner a minimum of two days before test is performed.

END OF SECTION 233533



## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 DIFFUSERS AND REGISTERS

- A. Manufacturers:
  - 1. Titus
  - 2. Anemostat; a Mestek Company
  - 3. Carnes
  - 4. Approved Equal
- B. **Refer to drawings for types of diffusers, registers and grilles in this project. Model #'s and Mfr's names have been provided on the drawings.**

### 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713



## SECTION 233813 - COMMERCIAL-KITCHEN HOODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes Type I commercial kitchen hood and fire suppression system.

#### 1.3 DEFINITIONS

- A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.
- B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.
- C. Type I Hood: A hood designed for grease exhaust applications.
- D. Type II Hood: A hood designed for heat and steam removal and for other non-grease applications.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Standard hoods.
  - 2. Filters/baffles.
  - 3. Fire-suppression systems.
  - 4. Lighting fixtures.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
  - 1. Shop Drawing Scale: 1/4 inch = 1 foot.
  - 2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
  - 3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
  - 4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
  - 5. Show water-supply and drain piping connections.
  - 6. Show control cabinets.
  - 7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.

8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
9. Design Calculations: Calculate requirements for selecting seismic restraints.
10. Wiring Diagrams: Power, signal, and control wiring.
11. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
  - a. Piping Diagram Scale: 1/4 inch = 1 foot.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  1. Coordination Drawing Scale: 1/4 inch = 1 foot.
  2. Suspended ceiling assembly components.
  3. Structural members to which equipment will be attached.
  4. Roof framing and support members for duct penetrations.
  5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Moldings on hoods and accessory equipment.
- B. Welding certificates.
- C. Manufacturer Seismic Qualification Certification: Submit certification that commercial kitchen hoods, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. NSF Compliance: Fabricate hoods according to NSF 2, "Food Equipment."
- E. SMACNA Compliance:
  - 1. Comply with SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."
  - 2. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible," second edition.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions using approved food facility equipment Shop Drawings. Coordinate fabrication with food facility equipment manufacturer to ensure that actual dimensions correspond to established dimensions.

## 1.8 COORDINATION

- A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish one complete set(s) of grease filters/baffles.

## PART 2 - PRODUCTS

### 2.1 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
  - 1. Minimum Thickness: 0.037 inch.
  - 2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
    - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
  - 3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
  - 4. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
  - 5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.
- C. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
  - 1. Color: As selected by Architect from manufacturer's full range.
  - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- D. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch (3-mm) thickness that does not chip, flake, or blister.
- E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

### 2.2 GENERAL HOOD FABRICATION REQUIREMENTS

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
  - 1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
  - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
  - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.



4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
  5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
  - C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
  - D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
  - E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
  - F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.
  - G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
  - H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.
  - I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
  - J. Fabricate seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
  - K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
  - L. Fabricate enclosure panels to ceiling and wall as follows:
    1. Fabricate panels on all exposed side(s) with same material as hood and extend from ceiling to top of hood canopy and from canopy to wall.
    2. Wall Offset Spacer: Minimum of 3 inches (75 mm).
    3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch- (1.58-mm-) thick, stainless-steel shelf tops.

## 2.3 TYPE I EXHAUST HOOD FABRICATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Captive Air
  2. Greenheck.
  3. Or Approved equal
- C. Weld all joints exposed to grease with continuous welds and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
1. Fabricate hoods according to NSF 2, "Food Equipment."
  2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
  3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
  4. Include access panels as required for access to fire dampers and fusible links.
  5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch- wide duct flange.
  6. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
    - a. Collar: Minimum 0.0598-inch- thick stainless steel, at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch-wide duct flange.
    - b. Blades: Minimum 0.1046-inch-thick stainless steel, counterbalanced to remain closed after actuation.
    - c. Blade Pivot and Spring: Stainless steel.
    - d. Fusible Link: Replaceable, 212 deg F rated.
  7. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.
    - a. Fire Rating: 1-1/2 hours.
    - b. Frame: SMACNA [Type B, with blades in airstream; fabricated with roll-formed, galvanized steel; with mitered and interlocking corners.
    - c. Blades: Roll-formed, interlocking or folded, minimum 0.034-inch-thick, galvanized-steel sheet.
    - d. Horizontal Dampers: Include a blade lock and stainless-steel closure spring.
    - e. Fusible Link: Replaceable, 165 deg Frated.
- D. Hood Configuration: Exhaust and makeup air.
1. Makeup air shall be introduced through front of canopy through perforated diffusers.
- E. Hood Style: Wall-mounted canopy.
- F. Filters/Baffles: Removable, stainless-steel with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.
- G. Removable Water-Wash Grease Extractor: Stainless steel, tested with hood according to UL 710.
- H. Stationary Water-Wash Grease Extractor: Integral, automatically self-cleaning, spraying hot water and detergent over the entire length of exhaust plenum. Fabricate to supply 140 deg F water at 1.25 gpm/ft. of hood length, at 40- to 60-psig inlet pressure.
1. Water Piping: ASTM A 270, Type 304 stainless steel.
  2. Fabricate to drain water and detergent to a collection trough having stainless-steel drain fittings.

3. Single, hood-mounting control panel with a solid-state, programmable controller shall control all hoods on Project. Wash cycle shall be factory set to operate for 10 minutes after fans stop.
  4. Detergent shall be supplied by an adjustable-flow, 120-V ac injection pump from a reservoir with a minimum capacity of 2.5 gal. (9.5 L).
- I. Lighting Fixtures: Surface-mounted, [fluorescent] [incandescent] fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc (753 lx) at 30 inches (762 mm) above finished floor.
1. Light switches shall be mounted [on front panel of hood canopy] [on wall adjacent to hood] [in hood control panel].
  2. Lighting Fixtures: Incandescent complying with UL 1598.
- J. Comply with requirements in Section 230923 "HVAC Instrumentation and Controls."
- K. Hood Controls: Hood-mounting control cabinet, factory wired to control groups of adjacent hoods, and fabricated of stainless steel.
1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan[s] during fire-suppression-agent release and to remain in operation until manually stopped. Motor starters shall comply with Division 26 Sections.
  2. Photocell and Temperature Control: Vary speed of exhaust and makeup air fans with variable frequency controllers, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system.
  3. Photocell and Temperature Control: Change speed (off, low, and high) of exhaust and makeup air fans with speed switch, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system.
  4. Photocell and Temperature Control: Cycle exhaust and makeup air fans on and off, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system. Specify safety device below to save cost of cleanup from fire-suppression-agent release.
  5. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.
- L. Capacities and Characteristics: Refer to schedules for information
- M. Provided with all features, options and accessories, per quantity required, as indicated:
- Construction: 100% 304 stainless steel
  - Filters: Stainless steel captrate solo with hook

- Insulation: Integral air / insulation barriers at perimeter and top, 0" clearance to combustibles
- Structural front panel, insulated
- Wall / Island canopy hood, length / size as per contract documents
- 2 ea. Front perforated supply plenum (PSP) with built-in 3" back standoff
- Insulation for PSP housing, as required
- 6 ea. LED lights with bulbs
- Stainless steel field wrap, approximately 18" high on all exposed sides
- Adjustable exhaust air volume control damper
- Hood Control Panel Package:
  - EMSplus11 modulating energy management system with smart controls
  - VFDs
  - Duct Temperature Sensors in all risers
  - Room Temperature Sensor
  - Configurable through Touch Screen Interface
  - EMS Duct Thermostat

## 2.4 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

### A. Wet-Chemical Fire-Suppression Systems shall be manufactured by:

1. Ansul Incorporated; Tyco International
2. Kidde Fire Systems
3. Badger Fire Protection
4. Approved Equal.

### B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

The system shall be a pre-engineered cartridge-operated type R-102 system utilizing Liquid Ansul agent, with a Fixed Nozzle distribution network. It shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96-2008 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27-2002.

System to provide connection to building Fire Alarm System per NFPA 17A; Section 3-2.1.5.

Fire protection remote pull stations mounted @ 48" AFF, located 10 ft. minimum to 20 ft. maximum from exhaust hood(s).

The extinguishing agent shall be a specifically formulated aqueous solution of organic salts contained in a S.S. tank with 3 gallons minimum capacity, and able to withstand test pressure of 330 PSI. A welded S.S. bracket shall be provided for mounting the tank.

The regulator releases mechanism shall be capable of providing sufficient expellant gas to discharge enough agent to meet the minimum nozzle discharge requirements. The mechanism shall have a visual indicator of "fired" condition. This mechanism shall be capable of being operated by fusible link detection, remote manual release and local manual release. The mechanism should be housed in a S.S. enclosure with cover containing identifications thereon.

Each discharge nozzle to be listed with UL approval for placement and size. Each nozzle shall have a rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up. All exposed piping to be chrome plated finish, and there shall be no exposed threads.

Plumbing Contractor to furnish mechanical (electrical) gas valve, up to 3" in size and coordinate the install/provisions to shut-off all fuel supplies to all cooking appliances beneath Type I exhaust hood upon activation of system. If electrical gas valve is to be utilized, Plumbing Contractor to furnish reset relay push button.

It is the responsibility of the Plumbing Contractor to install, coordinate and make any provisions necessary for complete operation of gas valve.

Kitchen Equipment Contractor to furnish and install a Class K Fire Extinguisher, dedicated to each room where a Type I exhaust hood is installed.

Upon completion of installation, the installer to perform a wet chemical test or at the time of the test, the authority having jurisdiction may allow the Contractor to use flushing concentrate and water solution. However, whichever is permitted, it must be in compliance with Code. This test shall activate the entire system, except the agent supply tank, which will be substituted by the test tank of like pressure and size. Following a satisfactory test, the original tank shall be replaced. The system shall then be certified to be in working order and all authorities shall be so advised in writing. Provide Owner with copies of all satisfaction/acceptance tests.

The system to be furnished and installed by a factory distributor in accordance with the manufacturer's instructions. This shall include mounting of the system units, manual releases, nozzles, actuating devices, and the running of all pipe and control tubing applicable to the R-102 system. If and when requested, submittal drawings concerning the fire system shall have affixed the seal and signature of a licensed engineer for the State in which they are to be installed. A 1-year service contract and maintenance program to be provided.

Mechanical Contractor is required to submit a copy of the hood suppression system shop drawing to the local authority having jurisdiction for approval, as well as submission to the Architect. In addition, shop drawings when submitted, must be signed and sealed by an engineer licensed to practice in the State where the system is to be installed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
  2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.
- 
- B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
  - C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.
  - D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
  - E. Install hoods to operate free from vibration.
  - F. Install seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
  - G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.
  - H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
  - I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.
  - J. Set initial temperatures and calibrate sensors.
  - K. Set field-adjustable switches.

### 3.3 CONNECTIONS

- A. Install piping with clearance to allow service and maintenance.
- B. Connect ducts according to requirements in Section 233300 "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid-tight joint.
- C. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
4. Perform hood performance tests required by authorities having jurisdiction.
5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set initial temperatures and calibrate sensors.
- B. Set field-adjustable switches.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 233813





## SECTION 233813 – COMMERCIAL-KITCHEN HOODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes Type I commercial kitchen hood and fire suppression system.

#### 1.3 DEFINITIONS

- A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.
- B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.
- C. Type I Hood: A hood designed for grease exhaust applications.
- D. Type II Hood: A hood designed for heat and steam removal and for other non-grease applications.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Standard hoods.
  - 2. Filters/baffles.
  - 3. Fire-suppression systems.
  - 4. Lighting fixtures.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
  - 1. Shop Drawing Scale: 1/4 inch = 1 foot.
  - 2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
  - 3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
  - 4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
  - 5. Show water-supply and drain piping connections.

6. Show control cabinets.
7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
9. Design Calculations: Calculate requirements for selecting seismic restraints.
10. Wiring Diagrams: Power, signal, and control wiring.
11. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
  - a. Piping Diagram Scale: 1/4 inch = 1 foot.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  1. Coordination Drawing Scale: 1/4 inch = 1 foot.
  2. Suspended ceiling assembly components.
  3. Structural members to which equipment will be attached.
  4. Roof framing and support members for duct penetrations.
  5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Moldings on hoods and accessory equipment.
- B. Welding certificates.
- C. Manufacturer Seismic Qualification Certification: Submit certification that commercial kitchen hoods, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

- b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.

#### 1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. NSF Compliance: Fabricate hoods according to NSF 2, "Food Equipment."
- E. SMACNA Compliance:
  - 1. Comply with SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."
  - 2. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible," second edition.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions using approved food facility equipment Shop Drawings. Coordinate fabrication with food facility equipment manufacturer to ensure that actual dimensions correspond to established dimensions.

#### 1.8 COORDINATION

- A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish one complete set(s) of grease filters/baffles.

## PART 2 - PRODUCTS

### 2.1 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Minimum Thickness: 0.037 inch.
  2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
    - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
  3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
  4. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
  5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.
- C. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
1. Color: As selected by Architect from manufacturer's full range.
  2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- D. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch (3-mm) thickness that does not chip, flake, or blister.
- E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

### 2.2 GENERAL HOOD FABRICATION REQUIREMENTS

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
  2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
  3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
  4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
  5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.
- G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.
- I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- J. Fabricate seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
- K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- L. Fabricate enclosure panels to ceiling and wall as follows:
1. Fabricate panels on all exposed side(s) with same material as hood and extend from ceiling to top of hood canopy and from canopy to wall.
  2. Wall Offset Spacer: Minimum of 3 inches (75 mm).

3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch- (1.58-mm-) thick, stainless-steel shelf tops.

## 2.3 TYPE I EXHAUST HOOD FABRICATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Captive Air
  2. Greenheck.
  3. Or Approved equal
- C. Weld all joints exposed to grease with continuous welds and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
  1. Fabricate hoods according to NSF 2, "Food Equipment."
  2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
  3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
  4. Include access panels as required for access to fire dampers and fusible links.
  5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch- wide duct flange.
  6. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
    - a. Collar: Minimum 0.0598-inch- thick stainless steel, at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch-wide duct flange.
    - b. Blades: Minimum 0.1046-inch-thick stainless steel, counterbalanced to remain closed after actuation.
    - c. Blade Pivot and Spring: Stainless steel.
    - d. Fusible Link: Replaceable, 212 deg F rated.
  7. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.
    - a. Fire Rating: 1-1/2 hours.
    - b. Frame: SMACNA [Type B, with blades in airstream; fabricated with roll-formed, galvanized steel; with mitered and interlocking corners.
    - c. Blades: Roll-formed, interlocking or folded, minimum 0.034-inch-thick, galvanized-steel sheet.
    - d. Horizontal Dampers: Include a blade lock and stainless-steel closure spring.
    - e. Fusible Link: Replaceable, 165 deg Frated.

- D. Hood Configuration: Exhaust and makeup air.
1. Makeup air shall be introduced through front of canopy through perforated diffusers.
- E. Hood Style: Wall-mounted canopy.
- F. Filters/Baffles: Removable, stainless-steel with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.
- G. Removable Water-Wash Grease Extractor: Stainless steel, tested with hood according to UL 710.
- H. Stationary Water-Wash Grease Extractor: Integral, automatically self-cleaning, spraying hot water and detergent over the entire length of exhaust plenum. Fabricate to supply 140 deg F water at 1.25 gpm/ft. of hood length, at 40- to 60-psig inlet pressure.
1. Water Piping: ASTM A 270, Type 304 stainless steel.
  2. Fabricate to drain water and detergent to a collection trough having stainless-steel drain fittings.
  3. Single, hood-mounting control panel with a solid-state, programmable controller shall control all hoods on Project. Wash cycle shall be factory set to operate for 10 minutes after fans stop.
  4. Detergent shall be supplied by an adjustable-flow, 120-V ac injection pump from a reservoir with a minimum capacity of 2.5 gal. (9.5 L).
- I. Lighting Fixtures: Surface-mounted, [fluorescent] [incandescent] fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc (753 lx) at 30 inches (762 mm) above finished floor.
1. Light switches shall be mounted [on front panel of hood canopy] [on wall adjacent to hood] [in hood control panel].
  2. Lighting Fixtures: Incandescent complying with UL 1598.
- J. Comply with requirements in Section 230923 "HVAC Instrumentation and Controls."
- K. Hood Controls: Hood-mounting control cabinet, factory wired to control groups of adjacent hoods, and fabricated of stainless steel.
1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan[s] during fire-suppression-agent release and to remain in operation until manually stopped. Motor starters shall comply with Division 16 Sections.
  2. Photocell and Temperature Control: Vary speed of exhaust and makeup air fans with variable frequency controllers, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit

to photocell and reflector to avoid grease accumulation that will negatively affect performance of system.

3. Photocell and Temperature Control: Change speed (off, low, and high) of exhaust and makeup air fans with speed switch, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system.
4. Photocell and Temperature Control: Cycle exhaust and makeup air fans on and off, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system. Specify safety device below to save cost of cleanup from fire-suppression-agent release.
5. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

L. Capacities and Characteristics: Refer to schedules for information

M. Provided with all features, options and accessories, per quantity required, as indicated:

- Construction: 100% 304 stainless steel
- Filters: Stainless steel captrate solo with hook
- Insulation: Integral air / insulation barriers at perimeter and top, 0" clearance to combustibles
- Structural front panel, insulated
- Wall / Island canopy hood, length / size as per contract documents
- 2 ea. Front perforated supply plenum (PSP) with built-in 3" back standoff
- Insulation for PSP housing, as required
- 6 ea. LED lights with bulbs
- Stainless steel field wrap, approximately 18" high on all exposed sides
- Adjustable exhaust air volume control damper
- Hood Control Panel Package:
  - EMSplus11 modulating energy management system with smart controls
  - VFDs
  - Duct Temperature Sensors in all risers
  - Room Temperature Sensor
  - Configurable through Touch Screen Interface
  - EMS Duct Thermostat

## 2.4 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Wet-Chemical Fire-Suppression Systems shall be manufactured by:

1. Ansul Incorporated; Tyco International
2. Kidde Fire Systems



3. Badger Fire Protection

4. Approved Equal.

- B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

The system shall be a pre-engineered cartridge-operated type R-102 system utilizing Liquid Ansul agent, with a Fixed Nozzle distribution network. It shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96-2008 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27-2002.

System to provide connection to building Fire Alarm System per NFPA 17A; Section 3-2.1.5.

Fire protection remote pull stations mounted @ 48" AFF, located 10 ft. minimum to 20 ft. maximum from exhaust hood(s).

The extinguishing agent shall be a specifically formulated aqueous solution of organic salts contained in a S.S. tank with 3 gallons minimum capacity, and able to withstand test pressure of 330 PSI. A welded S.S. bracket shall be provided for mounting the tank.

The regulator releases mechanism shall be capable of providing sufficient expellant gas to discharge enough agent to meet the minimum nozzle discharge requirements. The mechanism shall have a visual indicator of "fired" condition. This mechanism shall be capable of being operated by fusible link detection, remote manual release and local manual release. The mechanism should be housed in a S.S. enclosure with cover containing identifications thereon.

Each discharge nozzle to be listed with UL approval for placement and size. Each nozzle shall have a rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up. All exposed piping to be chrome plated finish, and there shall be no exposed threads.

Plumbing Contractor to furnish mechanical (electrical) gas valve, up to 3" in size and coordinate the install/provisions to shut-off all fuel supplies to all cooking appliances beneath Type I exhaust hood upon activation of system. If electrical gas valve is to be utilized, Plumbing Contractor to furnish reset relay push button.

It is the responsibility of the Plumbing Contractor to install, coordinate and make any provisions necessary for complete operation of gas valve.

Kitchen Equipment Contractor to furnish and install a Class K Fire Extinguisher, dedicated to each room where a Type I exhaust hood is installed.

Upon completion of installation, the installer to perform a wet chemical test or at the time of the test, the authority having jurisdiction may allow the Contractor to use flushing concentrate and water solution. However, whichever is permitted, it must be in compliance with Code. This test shall activate the entire system, except the agent supply tank, which will be substituted by the test tank of like pressure and size. Following a satisfactory test, the original tank shall be replaced. The system shall then be certified to be in working order and all authorities shall be so advised in writing. Provide Owner with copies of all satisfaction/acceptance tests.

The system to be furnished and installed by a factory distributor in accordance with the manufacturer's instructions. This shall include mounting of the system units, manual releases, nozzles, actuating devices, and the running of all pipe and control tubing applicable to the R-102 system. If and when requested, submittal drawings concerning the fire system shall have affixed the seal and signature of a licensed engineer for the State in which they are to be installed. A 1-year service contract and maintenance program to be provided.

Mechanical Contractor is required to submit a copy of the hood suppression system shop drawing to the local authority having jurisdiction for approval, as well as submission to the Architect. In addition, shop drawings when submitted, must be signed and sealed by an engineer licensed to practice in the State where the system is to be installed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Complete field assembly of hoods where required.
  - 1. Make closed butt and contact joints that do not require filler.
  - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.
- B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.
- D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- E. Install hoods to operate free from vibration.
- F. Install seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
- G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

- H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.
- J. Set initial temperatures and calibrate sensors.
- K. Set field-adjustable switches.

### 3.3 CONNECTIONS

- A. Install piping with clearance to allow service and maintenance.
- B. Connect ducts according to requirements in Section 233300 "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid-tight joint.
- C. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
  - 4. Perform hood performance tests required by authorities having jurisdiction.
  - 5. Perform fire-suppression system performance tests required by authorities having jurisdiction.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set initial temperatures and calibrate sensors.
- B. Set field-adjustable switches.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 233813

## SECTION 237200 - ENERGY RECOVERY VENTILATORS

### PART 1 – GENERAL

#### 1.01 SYSTEM DESCRIPTION

The fresh air ventilation system shall consist of the Daikin VAM-GVJU series (or approved equal manufacturers) energy recovery ventilator, incorporating a high-efficiency paper, cross-flow heat exchanger core in order to provide both sensible and latent heat recovery.

#### 1.02 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
- B. All wiring shall be in accordance with the National Electric Code (NEC).
- C. The system shall be certified in accordance with Air Conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 1060 and bear the AHRI Certified label.
- D. The heat exchanger core shall be tested in accordance with Underwriters Laboratories (UL) 723 and shall have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50.
- E. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
- F. System efficiency shall meet or exceed 65% thermal efficiency and 40% enthalpy recovery efficiency.

#### 1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.

#### 1.04 STANDARD LIMITED WARRANTY

Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the "installation date" which is one of the two dates below:

- a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
- b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

### PART 2 – PERFORMANCE

#### 2.01 PERFORMANCE

The energy recovery ventilator units shall be based on nominal airflow conditions:

System Model	Nominal Airflow (CFM)	External (in. EX-H/H/L	Static H <sub>2</sub> O)
VAM300GVJU	300	0.64 / 0.26 / 0.16	
VAM470GVJU	470	0.73 / 0.39 / 0.33	
VAM600GVJU	600	0.76 / 0.34 / 0.32	
VAM1200GVJU	1200	0.56 / 0.16 / 0.24	

The cooling thermal recovery and enthalpy recovery efficiencies shall be based on 95°F DB / 78°F WB for the entering supply air and 75°F DB / 63°F WB for the exhaust air, at both 100% nominal airflow and 75% nominal airflow.

The heating thermal recovery and enthalpy recovery efficiencies shall be based on 35°F DB / 33°F WB for the entering supply air and 70°F DB / 58°F WB for the exhaust air, at both 100% nominal airflow and 75% nominal airflow.

			VAM300GVJU	VAM470GVJU	VAM600GVJU	VAM1200GVJU
Temperature Recovery Efficiency %	Cooling	100%	65	68	72	72
		75%	70	72	74	74
	Heating	100%	65	66	70	70
		75%	69	69	73	73
Enthalpy Recovery Efficiency %	Cooling	100%	40	45	49	49
		75%	48	50	52	52
	Heating	100%	57	59	60	60
		75%	63	65	63	63

## 2.02 OPERATING RANGE

The equipment operating range shall be 5°F DB ~ 122°F DB and 80%RH or less.

## PART 3 – PRODUCTS

### 3.01 ENERGY RECOVER VENTILATOR

#### A. General:

The fresh air ventilation system shall consist of the Daikin VAM-GVJU series energy recovery ventilator, incorporating a high-efficiency paper, cross-flow heat exchanger core in order to provide both sensible and latent heat recovery.

#### B. Unit Cabinet:

1. The cabinet shall be constructed of galvanized steel plate.
2. The unit shall be internally insulated with a self-extinguishing urethane foam.

#### C. Fans:

1. The fans shall be direct-drive, forward-curved centrifugal type with statically and dynamically balanced impellers with extra-high, high, and low fan speeds.
2. The fan motor(s) shall operate on 208-230 volts, 1 phase, 60 hertz.
3. The air flow rate shall be available in extra-high, high, and low settings.
4. The fan motor shall be thermally protected.

D. Filter:

1. The supply and exhaust air streams shall be filtered prior to entering the heat exchanger core by means of a multidirectional fibrous fleece filter.

E. Heat Exchanger:

1. The heat exchanger element shall consist of a specially processed, nonflammable, HEP (high efficiency paper) heat exchanger designed to allow the exchange of both sensible and latent energy between the supply and exhaust airstreams. The core material shall be tested as specified in UL 723 and have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50.

F. Electrical:

1. A separate power supply will be required of 208-230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

G. Control:

1. The unit shall be compatible with Daikin D-III net via the F1/F2 terminal.
2. The unit shall be capable of the following methods of control:
  - i. Independent control – The unit shall be operable directly by a local remote controller.
  - ii. Interlocked control – The unit shall be operable in conjunction with a VRV or Sky Air system by a local remote controller.
  - iii. Centralized control – The unit shall be operable by a centralized control without the need for a local remote controller to be connected.
3. The unit shall be capable of the following modes of operation:
  - i. Energy recovery
  - ii. Bypass ventilation – The unit shall be capable of bypass ventilation which diverts air flow around the heat exchanger core. No energy recovery is performed.
  - iii. Auto Mode – The unit shall be capable of automatically determining the need for performing energy recovery or bypassing the heat exchanger core based on the current fan coil operation mode and the current indoor and outdoor temperatures.
  - iv. Fresh-up Mode (supply) – The unit shall be capable of entering Fresh-up Supply operation in which the incoming supply air ratio is greater than the exhaust air ratio.
  - v. Fresh-up Mode (exhaust) – The unit shall be capable of entering Fresh-up Exhaust operation in which the incoming supply air ratio is less than the exhaust air ratio.
  - vi. Night Time Free Cooling – The unit shall be capable of Night Time Free Cooling in which the unit will automatically energize to lower the space temperature based on the current outdoor temperature, the current indoor temperature, current set point, and the operating state of the indoor fan coils.

H. Installation

1. The unit shall be capable of inverted installation if required by ductwork and access clearance requirements.
2. The unit shall not require a condensate drain connection or condensate pan of any kind.

I. Accessories

1. Replacement air filter.
2. DCS302C71 – Central Remote Controller
3. DST301BA61 – Schedule Timer

## PART 4 - EXECUTION

### 4.1 INSTALLATION

- A. Install units level and plumb.
- B. Install in-door units using manufacturer's standard mounting devices securely fastened to building structure.

### 4.2 CONNECTIONS

- A. Ductwork installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install ductwork adjacent to unit to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

### 4.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 4.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks according to manufacturer's written instructions.



#### 4.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures / Demonstration and Training."

END OF SECTION 237200



## SECTION 237413 – PACKAGED ROOFTOP HVAC UNITS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

#### 1.02 GENERAL DESCRIPTION

- A. This section includes the design, controls and installation requirements for packaged rooftop units.

#### 1.03 QUALITY ASSURANCE

- A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.
- E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- F. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.
- G. Unit shall be approved for use in and outside High Velocity Hurricane Zones (HVHZ) by the Florida Building Code (FL# 15031), when using the required steel rooftop curb and attachment methods. Maximum allowable lateral wind pressure is +100psf/-100psf. Maximum allowable uplift is +50psf/-50psf. Positive and negative required design pressures calculated for use with this system shall be determined by others on a job specific basis, in accordance with the governing code. Site specific pressures shall be less than or equal to the listed positive or negative allowable lateral wind design pressure and allowable uplift values for the product.

#### 1.04 SUBMITTALS

- A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.

- B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

#### 1.06 WARRANTY

- A. Manufacturer shall provide a limited "parts only" warranty for a period of 24 months from the date of equipment startup. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURER

- A. Products shall be provided by the following manufacturers:
  - 1. AAON
  - 2. Trane
  - 3. Daikin Applied
  - 4. Or Approved Equal

**Note:** In case any of the manufacturers other than the basis of design are submitted for use, the contractor will be responsible for all changes associated with that submission, including providing adapter curbs, structural reinforcement, etc.

- B. R-410A refrigerant
- C. Variable capacity compressor with 10-100% capacity control
- D. Direct drive supply fans
- E. Double wall cabinet construction

- F. Insulation with a minimum R-value of 13
- G. Stainless steel drain pans
- H. Hinged access doors with lockable handles
- I. All other provisions of the specifications must be satisfactorily addressed

## 2.02 ROOFTOP UNITS

### A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, exhaust fans, energy recovery wheels, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

### B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a max-

imum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.
11. Unit base shall be fabricated of 1 inch thick double wall, impact resistant, rigid polyurethane foam panels.

C. Electrical

1. Unit shall have a 5kAIC SCCR.
2. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
3. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Exhaust Fans

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
5. Unit shall include belt driven, unhooded, backward curved, plenum exhaust fans.
6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. Cooling Coils

1. Evaporator Coils
  - a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
  - b. Coils shall have interlaced circuitry and shall be standard capacity.
  - c. Coils shall be hydrogen leak tested.
  - d. Coils shall be furnished with factory installed expansion valves.

G. Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuits which shall be capable of modulation from 10-100% of its capacity.
8. Lead refrigeration circuits shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings

and overcooling of the space.

H. Condensers

1. Air-Cooled Condenser

- a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
- b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
- c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
- d. Coils shall be hydrogen or helium leak tested.
- e. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.
5. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be include on the condensate drain

J. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
2. Unit shall include a clogged filter switch.

K. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leak-



age per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.

2. Economizer shall be furnished with return air CO2 override.

L. Energy Recovery

1. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
4. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
5. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
6. Hinged service access doors shall allow access to the wheel.

a. Aluminum Energy Recovery Wheels

1. Unit shall contain a factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a steel-enforced drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.
2. Aluminum Energy recovery wheel shall be covered under the standard AAON limited parts warranty; the first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period,

provided the written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts.

3. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coated segments shall be cleanable with low temperature steam, hot water, or light detergent without degrading the latent recovery.

#### M. Controls

##### 1. Factory Installed and Factory Provided Controller

- a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
- b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
- c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
- d. Variable Air Volume Controller
  1. Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy. Supply fan speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.
  2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
- e. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a BACnet network. [Orion Controls System]

#### N. Accessories

1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION, OPERATION, AND MAINTENANCE

- A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.
- C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

### 3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
  - 1. Gas Piping: Comply with applicable requirements in Division 15 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination in roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
  - 4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- (50-mm-) thick, acoustic duct liner.
- D. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to Division 16 Section "Grounding and Bonding."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field quality-control tests and inspections and prepare test reports:
  - 1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove malfunctioning units, replace with new units, and retest as specified above.

#### 3.04 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  1. Inspect for visible damage to unit casing.
  2. Inspect for visible damage to furnace combustion chamber.
  3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
  4. Inspect internal insulation.
  5. Verify that labels are clearly visible.
  6. Verify that clearances have been provided for servicing.
  7. Verify that controls are connected and operable.
  8. Verify that filters are installed.
  9. Clean outside coil and inspect for construction debris.
  10. Clean furnace flue and inspect for construction debris.
  11. Connect and purge gas line.
  12. Adjust vibration isolators.
  13. Inspect operation of barometric dampers.
  14. Lubricate bearings on fan.
  15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  16. Adjust fan belts to proper alignment and tension.
  17. Start unit according to manufacturer's written instructions.
    - a. Start refrigeration system in summer only.
    - b. Complete startup sheets and attach copy with Contractor's startup report.
  18. Inspect and record performance of interlocks and protective devices; verify sequences.
  19. Operate unit for an initial period as recommended or required by manufacturer.

20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
  - a. Measure gas pressure on manifold.
  - b. Measure combustion-air temperature at inlet to combustion chamber.
  - c. Measure flue-gas temperature at furnace discharge.
  - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
  - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:
  - a. Coil leaving-air, dry- and wet-bulb temperatures.
  - b. Coil entering-air, dry- and wet-bulb temperatures.
  - c. Outside-air, dry-bulb temperature.
  - d. Outside-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outside-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
  - a. High-limit heat exchanger.
  - b. Warm-up for morning cycle.
  - c. Freezestat operation.
  - d. Economizer to limited outside-air changeover.
  - e. Alarms.
29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.05 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 1 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION 237413

## SECTION 238119 – SELF-CONTAINED AIR-CONDITIONERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This section includes self-contained air conditioners/unit ventilators and accessories as indicated on drawings and schedules, and by requirements of this section.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. AHRI Compliance: Test and rate Self Contained Air Conditioner unit ventilator in accordance with AHRI Standard 390 "Single Packaged Vertical Air Conditioners and Heat Pumps."
- B. NFPA 70 – National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ANSI/ASHRAE/IES 90.1-2013 Compliance: Applicable requirements in ANSI/ASHRAE/IES 90.1-2013, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Listed on <https://www.regulations.doe.gov/certification-data/>. Complies with Energy Policy and Conservation Act (42 USC 6311-6317).

- F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- G. The unit shall be constructed in accordance with ANSI standards, and a label shall be affixed to the unit listing the product code under which it is registered.

#### 1.5 WARRANTY

- A. Standard Unit Warranty: For units equipped with Modine Controls System - All Components Warranty: Two years from date of first beneficial use by buyer or any other user, within two years from date of resale by buyer in any unchanged condition, or within 30 months from date of shipment from seller, whichever occurs first.
- B. Extended Compressor Warranty: Compressor warranty five years from date of first beneficial use by buyer or any other user, within five years from date of resale by buyer in any unchanged condition, or within sixty-six months from date of shipment from seller, whichever occurs first.

#### 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: Two spare sets of filters for each unit.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Furnish and install a self-contained vertical floor standing air conditioning unit ventilator, DX Cooling Only. Constructed in accordance with UL and CSA standards with a label affixed to the unit listing the product code under which it is registered. Unit performance shall be certified in accordance with AHRI 390. Unit shall be constructed following ISO: 9001 quality control program procedures and be fully assembled, charged, wired, and tested prior to shipment.

#### 2.2 MANUFACTURERS

- A. Basis-of-Design Products: The design for self-contained air conditioners shall be the following:
  - 1. Modine
  - 2. Or Approved equal.

#### 2.3 CABINET

- A. Insulation: 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials.
  - 1. Fire-Hazard Classification: Insulation shall have a fire rating of UL94HF-1.
  - 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.



- B. Cabinet Construction: Constructed from aluminized steel with 16-gauge panels, degreased and coated with electrostatically applied baked-on polyester powder paint.
- C. Cabinet Interior: Interior right and left hand sides shall employ 20 gauge galvanized steel full double wall construction.
- D. Cabinet Finish: The unit color shall be Antique White.
  - 1. Paint finish shall be easily cleanable and hard wearing to give maximum protection.
- E. Service and Maintenance Access: All service and maintenance access shall be possible through the front of the unit only.
- F. Return air openings shall be integrated into the cabinet sides.
- G. Access door is factory installed on the front of the unit. Face of door shall be absent of return air openings to allow for easy cleaning. Door shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty ¼" zinc plated steel plunger hinges with a spring-loaded ¼" zinc plated steel pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.
- H. Condensate Connection: Factory installed condensate connection stub provided for connection to the field installed building condensate drain.

## 2.4 REFRIGERATION SYSTEM

- A. Compressor: Two stage hermetic scroll compressor mounted on four (4) 125# all neoprene rubber 35-45 durometer vibration isolators for quiet operation. Compressor contains an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased.
  - 1. An internal overload protector included to protect compressor against excessive motor temperatures and currents.
  - 2. Compressor is equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start up.
  - 3. Compressor is equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start up.
- B. Compressor Acoustic Wrap with Base: For improved sound attenuation, compressor casing consists of 18oz PVC barrier laminated to 1/2 inch non-woven polyester. Casing includes integral 4 inch foil backed fiberglass heat shield for use with crankcase heater. Compressor base consists of 2 pound EVA barrier with embedded ¼ inch layered closed cell foam. Cover is easily removable for service.
- C. Refrigeration Circuit (Cooling Only): Refrigeration system utilizes HFC-R410A and contains a factory fitted thermal expansion device and filter drier. Fitted with factory set automatic reset high-pressure and low-pressure cut-out switches and a sight glass included for system observation.
- D. Indoor Coil: Patented micro-channel CF™ evaporator coil designed for maximum heat transfer with minimum footprint and pressure drop. Quick draining evaporator coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

- E. Outdoor Coil: Enhanced, high efficiency, cross rifled coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit.

## 2.5 FANS AND MOTORS

- A. The indoor fan assembly consists of one blower inside teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high efficiency and low audible noise. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.
- B. Outdoor (Condenser) Fan Assembly: The outdoor fan assembly consists of one backward curved plug fan with centrifugal blower wheel powered by an electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics are possible for ultra-high efficiency and low audible noise. Fan design capable of overcoming external static pressures brought on by rear extensions backs and duct work connected to the fan discharge opening. Fan is sized such that powered exhaust shall be integral to the unit to prevent over pressurization of the space when the unit is introducing outside air. Capable of exhausting 100% equivalent of the fresh air intake of the unit. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly. Note: propeller fans are NOT acceptable.

## 2.6 FILTERS

- A. Filter: 2" thick radial pleated disposable cotton and synthetic blend filters. Minimum Efficiency Reporting Value of MERV 8 per ASHRAE standard 52.2.

## 2.7 CONTROL PANEL

- A. Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.
- B. Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.
- C. Plug and Socket Wiring: Supply and Exhaust Fan decks, compressor, damper assembly, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

## 2.8 ECONOMIZER

- A. Single-blade damper that pivots using a central single shaft attached to a single actuator allowing for complete balance of the return, outside, and exhaust air streams. Capable of full modulation allowing any mixture of outside air and return air to be possible. Will allow for 100%

of the units airflow to be taken from the outside during conditions allowing for full economizer savings. Damper blade edges lined with rubber gasket to prevent air infiltration in full recirculation or full economizer operation. Complete damper assembly slides out of unit on rails allowing for the damper assembly to be removed through the front of the unit if it requires service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

- B. Outside Air Damper: Outside air damper and actuator provided for protection from outdoor elements when unit is not in use.
- C. Damper Actuator: Low voltage modulating damper actuator with spring-return, fail safe. When power is cut to actuator, damper actuator will force damper blade closed to outside air.

## 2.9 HOT GAS REHEAT

- A. Unit is equipped with a reclaim valve and a second condenser coil (reheat coil). When the unit enters the dehumidification mode, the unit will direct refrigerant to reheat coil to maintain space dry bulb temperature. When unit exits dehumidification mode, valve will reclaim refrigerant in reheat coil back to the system.

## 2.10 CONTROLS

- A. Modine Control System: The unit is fitted with a programmable microprocessor controller provided by the unit manufacturer mounted outside the air stream in the control panel. The controller is designed specifically for operating the unit in its most energy efficient manner using pre-engineered control strategies. The microprocessor determines mode of operation based on the factory installed return air and supply air temperature sensors.
- B. Factory installed controls shall enable the unit to operate in the following modes:
  - 1. Free Cooling – using outside air in favorable conditions.
  - 2. Stage One Mechanical Cooling: 67% capacity compressor, low speed supply fan.
  - 3. Stage Two Mechanical Cooling: Controller adjusts compressor capacity and supply fan speed based on load conditions through a sequence that is proprietary to Modine Controls.
  - 4. Stage Three Mechanical Cooling: 100% capacity compressor, high speed supply fan.
  - 5. Dehumidification: Controller adjusts compressor capacity based on dehumidification requirements through a sequence that is proprietary to Modine Controls, low speed supply fan, hot gas reheat valve is opened.
  - 6. Heating: Hot water heat, high speed supply fan.
- C. The microprocessor controller shall also modify the minimum damper position to compensate for mode of operation and fan speed.
- D. Free Cooling Sequence: If the return air temperature is higher than the occupied set point and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will signal the fresh air economizer damper. This will automatically modulate between 0-100% and the conditioned space temperature will be maintained by full fresh air or “free cooling”. During free cooling the outdoor fan will operate at reduced speed to match supply air volume. The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.
- E. BACnet Card: The factory Microprocessor Control includes a plug-in card allowing for complete compatibility with an MS/TP BACnet control system.

- F. Time Clock Card: The Modine Control System microprocessor includes a time clock card for units where time functions, night and weekend setback, etc. are not transmitted from a building management system or remote central time clock. The time clock shall have a full 7-day schedule and calendar function incorporated. The 7-day schedule shall have two adjustable occupied/unoccupied periods per day. The calendar function shall allow 20 calendar periods (start date / stop date = 1 period).
- G. Display Module: User Interface for the Factory Microprocessor Controller. Displays status of controllers inputs and outputs, allows for unoccupied/occupied set-point changes, displays service settings, allows adjustment of control parameters, and is used for troubleshooting the unit. Provide one display module for the owner's use.
- H. Wall Mounted Digital Thermostat with Humidity Sensor: Digital thermostat with humidity sensing used in conjunction with the Factory Microprocessor Control displays current room temperature, cooling/heating set-point, current room humidity level, humidity set-point, current time and day, current occupied mode, and the unit's compressor and fan speeds. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature and humidity set-point adjustment. The allowable set-point adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Thermostat mounted remote from the unit.
- I. Phase Failure Relay: The unit shall be provided with an internally mounted phase measurement relay to monitor the 3-phase power supply for phase sequence, phase failure, asymmetry, under voltage and overvoltage.
- J. Dirty Filter Switch: The unit shall be provided with an internally mounted pressure switch to detect pressure drop across the filters and indicate dirty or clogged filters.
- K. The unit shall be provided with an internally mounted current sensor to monitor the status of the supply fan.
- L. The unit shall be provided with an internally mounted current sensor to monitor the status of the outdoor fan.

## 2.11 HOT WATER HEATING

- A. Hot Water Coil (unit mounted): Unit is equipped with a one row hot water heating coil integral to the unit mounted in the reheat position relative to the evaporator coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Coil is fitted with both an air bleed and a drain plug. Note: field installed and piped coil assemblies are NOT acceptable.
- B. The hot water coil shall include the following:
  1. 3/4" three-way modulating valve for capacity control
  2. Two manual shut-off valves
  3. 3/4" hot water strainer
  4. 3/4" hot water balancing valve
  5. 3/4" hot water circuit setter
  6. 3/4" hot water drain with hose and bib
  7. 3/4" PT Ports

## 2.12 ADDITIONAL FACTORY INSTALLED OPTIONS

- A. Condensate Pump: Capable of 13 GPH flow rate at maximum discharge head of 20 feet of lift. Includes piston pump, detection unit, built-in thermal protection and safety switch.
- B. Outdoor Coil Filter: A set of two 20-30 PPI polyester foam washable filters attached to a corrosion resistant metal wire frame fitted across the air inlet of the outdoor coil. Average synthetic dust weight arrestance of 60-80%. The filter is reusable and can be vacuum cleaned.
- C. Disconnect Switch: Located on the control panel, a power disconnect switch sized for the full load amperage of the unit. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

## 2.13 FIELD INSTALLED ACCESSORIES

- A. Wall Sleeve: Designed to provide a sealed plenum for the fresh air intake and exhaust air outlet on the back of the classroom unit to the outside of the building. Intake and exhaust airstreams are separated with an insulated horizontal splitter plate. A two-piece frame allows for the sleeve to adjust to wall depths between 8" and 14". Includes double-sided gasket to create an air tight seal between the wall sleeves and the back of the unit.
- B. Louver: An outdoor louver suitable for masonry, glass, or panel wall construction. The louvers are flanged style with the following finish:
  - 1. Aluminum with bird screen and a clear anodized finish - Greenheck ESD435 Model - AMCA rated.
- C. Duct Flange: Factory fitted discharge duct flange allowing for easy field connection of a discharge duct to top of the unit.
- D. Duct Shroud: 38" three sided duct shroud field mounted on top of the unit for extending the cabinet through the ceiling/soffit. Field trimmed by the installing contractor to suit the ceiling height. Finished and painted to match the unit
- E. Supply Air Replacement Filters: The unit shall be provided with 1 set(s) of MERV 8 supply air replacement filters (Qty of 2).

Outdoor Coil Replacement Filter: The unit shall be provided with a MERV 8 outdoor coil replacement filter.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. General: Examine areas and conditions under which self-contained air conditioners are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

### 3.2 INSTALLATION

- A. General: Install self-contained air conditioners in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
  - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Ductwork: Refer to Division 23 section "Metal Ductwork". Connect supply and return ducts to units with flexible duct connections. Provide transitions to exactly match unit duct connection size.
- D. Drain Piping: Connect self-contained air conditioner's condensate drain to nearest indirect waste connection, or as indicated.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Ground equipment according to Division 16 Section "Grounding and Bonding."
- D. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures / Demonstration and Training."

END OF SECTION 238119





## SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes split-DX heat pump and air conditioning units.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

- B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

## 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set of filters for each unit.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Daikin Applied
  - 2. Mitsubishi
  - 3. Fujitsu
  - 4. LG HVAC
  - 5. Or Approved Equal.

### 2.2 UNITS

- A. System Description: The Air Conditioner system shall be a Trane split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, matched capacity indoor cassette units that shall be equipped with a wired wall mounted, wireless wall mounted remote controller. **Refer the drawings and mechanical schedules for types of models of units.**
- B. Quality Assurance:
  - 1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
  - 2. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
  - 3. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.
  - 4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
  - 5. A dry air holding charge shall be provided in the indoor section.

6. The outdoor unit shall be pre-charged with R-410a refrigerant for 70 feet (20 meters) of refrigerant tubing.
7. System efficiency shall meet or exceed SEER values as scheduled on the plans.

C. Delivery, Storage and Handling:

1. Unit shall be stored and handled according to the manufacturer's recommendations.
2. The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

D. Warranty:

1. The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
2. Manufacturer shall have over thirty (30) years of continuous experience in the U.S. market.

E. Outdoor Unit Design:

1. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.
2. The outdoor unit shall be capable of cooling operation down to 0°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle shall be required).
3. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units.
4. System shall operate at up to a maximum refrigerant tubing length of 165 feet (50 meters) for the 36,000 units between indoor and outdoor units without the need for line size changes, traps or additional oil.
5. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
6. Outdoor unit sound level shall not exceed 48dB (A).

F. Cabinet:

1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.
2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

4. The fan grill shall be of ABS plastic.
5. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

G. Fan:

1. Each unit shall be furnished with a single DC fan motor.
2. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
3. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

H. Coil:

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.
3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

I. Compressor:

1. The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.
2. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.
3. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
4. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

J. Electrical:

1. The electrical power of the unit shall be 208volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
2. Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.
3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
4. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

K. Operating Range:

1. The Cooling Operating Temperature Range shall be 0°F to 118°F.
2. The Heating Operating Temperature Range shall be -4°F to 78°F.

L. Unit Cabinet:

1. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white.

M. Fan:

1. The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

O. Vane:

1. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

P. Filter:

1. Return air shall be filtered by means of an easily removable washable filter.

Q. Coil:

1. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed

with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing.

R. Electrical:

1. The electrical power of the unit shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

S. Performance:

1. Each system shall perform in accordance to the ratings shown in the manufacturer catalog. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit.

T. System Control:

1. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

U. System Control: The indoor unit control board shall have auxiliary control contact connectors.

V. Remote Controllers: All remote controllers need to be ordered separately from the unit. Provide remote controllers as called out on the drawings and mechanical schedules.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install in-door units using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounting outdoor units on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
- D. Install seismic restraints.
- E. Install outdoor units on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 23 Section "Mechanical Vibration and Seismic Controls."

- F. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures / Demonstration and Training."

END OF SECTION 238126





## SECTION 238223 – UNIT VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes unit ventilators and accessories for 2-pipe system.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for each unit type and configuration.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Details of anchorages and attachments to structure and to supported equipment.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Manufacturer Seismic Qualification Certification: Submit certification that unit ventilators, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For unit ventilators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

G. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with minimum COP/efficiency levels according to ASHRAE/IESNA 90.1.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of unit ventilators and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of wall sleeves for outdoor-air intake and relief dampers.

#### 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Unit Ventilator Filters: Furnish 2 spare filter for each filter installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
  1. Trane
  2. Daikin Applied
  3. Carrier
  4. Or Approved Equal

#### 2.2 MANUFACTURED UNITS

- A. Description: Factory-packaged and -tested units rated according to ARI 840, ASHRAE 33, and UL 1995, including finished cabinet, filter, cooling coil, drain pan, supply-air fan, motor, and hydronic/steam heating coil.

## 2.3 UNIT VENTILATORS:

- A. General: Deliver and install a complete unit ventilator certified for ventilation at AHRI-840, or tested by an independent testing and balancing lab witnessed by owner's representative.
- B. Safety: All standard units shall be UL-listed in United States and Canada and comply with NFPA 90A requirements. The unit ventilators shall be certified and rated in accordance to the following listings for performance proof and safety: ETL, AHRI-840, AHRI-350, LonMark, BAC-net.
- C. Unit Construction:
  - 1. Unit shall be constructed of heavy gauge steel components to form a ridged frame that is suitable for rigorous classroom duty. Unless painted for cosmetic reasons, the frame shall be entirely of galvanized material to prevent corrosion.
  - 2. Exterior panels must be constructed of heavy gauge steel that have been cleaned and pretreated prior to painting to afford the maximum corrosion resistance possible, even after scratches that might appear during normal use. These panels shall be coated with at least 2 mil of the highest quality, polyester baked-on textured powder paint.
  - 3. Unit tops shall be constructed of heavy gauge steel coated with a textured finish baked on powder paint to resist both corrosion and marring during normal use.
  - 4. Units shall be constructed such that normal unit operation is not affected by removal of front panels for routine maintenance or troubleshooting/adjustments of control components. Units requiring all front panels to be installed for correct unit operation shall not be accepted.
- D. Insulation:
  - 1. The standard unit shall be constructed such that there shall be no fiberglass in the airstreams.
- F. Bar Stock Discharge Grille:
  - 1. Discharge grilles shall be welded steel continuous blade design with spacing no more than .230" such that normal pencils cannot penetrate.
  - 2. To further ensure that debris cannot be placed into the fans, the grille shall be backed by screens with spaces no larger than 1/4 inch.
- G. Drain Pans:
  - 1. Drain pans shall be furnished on all units. Pans shall be insulated to ensure that they do not sweat during the cooling season and be sloped in two planes to prevent standing water. Drain stubs shall be at least 7/8" OD. Both left and right hand stubs shall be furnished on all units; connection shall be field reversible.
- H. Fan Motor:
  - 1. All units shall be furnished with an integrally protected, programmable, electronically commutated, polyphase motor that has been preprogrammed with the capability of delivering at least three distinct air volumes. For hydronic units these air volumes shall be 100% rated air for Max, approximately 70% of rated air for high, and approximately 50%

of rated air for low. Motors that are not programmable to ensure constant correct air delivery shall not be acceptable.

I. Fans:

1. Fans shall be large diameter (at least 8") for low speed, quiet operation and shall be constructed of high impact mineral filled polymer material (500-1500 CFM). Fans must be mounted on a continuous, precision ground hollow shaft that is supported on one end by a long life bearing and connected to the motor shaft by a coaxial steel coupling with resilient inner ring. Motors shall be easily removable and secured in a wire motor mount bolted to the unit frame. The wire mount shall be mechanically isolated from the frame of the unit by resilient bushings at each mounting point of the motor mount assembly.

J. Room Air/Outdoor Air Dampers:

1. Damper shall be constructed of one piece heavy gauge extruded aluminum material that has been stiffened by use of multiple components to afford maximum rigidity, strength and corrosion resistance. Seats shall be deep pile polyester material on all side edges; damper blades shall use dual durometer PVC seals with memory suitable for use from -30°F to 160°F. The damper shafts shall pass through trouble-free nylon bearings and be connected to the damper blade using multiple fasteners that utilize vibration resistant components for maximum trouble-free life.
2. The damper must be insulated with closed cell foam insulation. Optional cold weather damper must be available for maximum cold weather protection.

K. Agency Listings:

1. All units shall be listed by NRTL (Nationally Recognized Testing laboratory) such as ETL. All units shall have certified performance under applicable ARI 840 program for unit ventilators. The manufacturer shall furnish proof of such certification prior to final approval of the product.

L. Coils:

1. Hot water coil shall be constructed of 5/8-inch, sigma-flow, tube-in-tube, distributing coil design. Coil tubing shall be mechanically expanded into evenly spaced aluminum fins. The supply and return connections shall be on the same side, and include a 1-inch female pipe thread (FPT) termination.
2. The coil shall be pitched by the manufacturer to provide condensate drainage for freeze protection.

M. Filters:

1. The units shall be furnished with throwaway, permanent, renewable filters. This filter shall be placed in the air stream such that all outdoor and/or return air passes through a single filter. Separate filtration of the outdoor air and return air is not acceptable. Permanent filters shall be constructed utilizing a heavy gauge aluminum frame with spun aluminum media suitable for repeated washing and reuse. Renewable filters shall be constructed of heavy gauge galvanized, painted frames fitted with fiberglass media. The frame shall be easily disassembled for media renewal. Units shall be constructed to accept 2" filters without cabinet modification.

N. Temperature Controls:

1. The unit ventilator manufacturer shall furnish, install, wire and factory test a complete control package suitable for the unit type(s) selected. The sequence of operation shall be ASHRAE Cycle II with minimum position of the outdoor actuator adjustable by the installing contractor, balance contractor, and owner/operator.
  2. The desired room temperature and the (optional) night setback offset shall be adjustable at the unit keypad or at the wall thermostat.
- O. Night Set Back Relay:
1. A unit mounted relay shall be furnished that can be used by the controls contractor to signal the unit to go to occupied/ unoccupied mode from a remote source. The relay furnished shall have a 24 VAC coil. An optional timeclock with 7 day 24 hour, skip-a-day feature shall be provided. Timeclock will have captive trippers in 2 hour increments, holiday switch and 7 day reserve.
- P. Control Valve: Three-way modulating valves shall be rated for a maximum 50 psig pressure differential across the valve.
- Q. DDC controls shall be furnished and installed by DDC subcontractor and connected to "Andover" building management system. Refer to Spec. Section 232309.11 "Digital Control Systems for HVAC" for requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive unit ventilators for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit ventilator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install unit ventilators to comply with NFPA 90A.
- B. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
  1. Install piping adjacent to machine to allow service and maintenance.

2. Connect piping to unit ventilator factory hydronic piping package. Install piping package if shipped loose.
  3. Connect condensate drain to indirect waste or as indicated on the drawings.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain unit ventilators. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 238223

## SECTION 238236 - FINNED-TUBE RADIATION HEATERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes hydronic finned-tube radiation heaters.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include details and dimensions of custom-fabricated enclosures.
  - 4. Indicate location and size of each field connection.
  - 5. Indicate location and arrangement of piping valves and specialties.
  - 6. Indicate location and arrangement of integral controls.
  - 7. Include enclosure joints, corner pieces, access doors, and other accessories.
  - 8. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Color Samples for Initial Selection: For finned-tube radiation heaters with factory-applied color finishes.
- E. Color Samples for Verification: For each type of exposed finish.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members, including wall construction, to which finned-tube radiation heaters will be attached.

2. Method of attaching finned-tube radiation heaters to building structure.
3. Penetrations of fire-rated wall and floor assemblies.

B. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 BASEBOARD RADIATION HEATERS

#### A. APPROVED MANUFACTURERS

1. Sterling HVAC Products
2. Engineered Air
3. Zehnder Rittling
4. Or Approved Equal

B. Performance Ratings: Rate baseboard radiation heaters according to Hydronics Institute's "I=B=R Testing and Rating Standard for Baseboard Radiation."

C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on polypropylene element glides. One end of tube shall be belled.

D. Enclosures: Minimum 14-gauge steel, removable front cover.

1. Full-height back.
2. Full-length damper.
3. End panel.
4. End caps.
5. Inside and outside corners.
6. Valve access door.
7. Joiner pieces to snap together.
8. Enclosure Height: Refer to drawings and schedule.
9. Enclosure Depth: Refer to drawings and schedule.
10. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.
11. Element Brackets: Primed and painted steel to support front panel and element.

### 2.2 FINNED-TUBE RADIATION HEATERS

#### A. APPROVED MANUFACTURERS

1. Sterling HVAC Products
2. Engineered Air
3. Zehnder Rittling
4. Or Approved Equal

B. Performance Ratings: Rate finned-tube radiation heaters according to Hydronics Institute's "I=B=R Testing and Rating Standard for Finned-Tube (Commercial) Radiation."

C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on element supports. One end of tube shall be belled.



- D. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.
- E. Front Panel: Minimum 14-gauge steel.
- F. Wall-Mounted Back Panel: Minimum 18-gauge steel, full height, with full-length channel support for front panel without exposed fasteners.
- G. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.
- H. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.
- I. Damper: Knob-operated internal damper at enclosure outlet.
- J. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.
- K. Enclosure Style & Dimensions: Refer to drawings and schedule.
- L. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for hydronic-piping connections to verify actual locations before installation of finned-tube radiation heaters.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 BASEBOARD RADIATION HEATER INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install access doors for access to valves.
- E. Install enclosure continuously from wall to wall.
- F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
- G. Install valves within reach of access door provided in enclosure.

- H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.
- I. Install piping within pedestals for freestanding units.

### 3.3 FINNED-TUBE RADIATION HEATER INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install access doors for access to valves.
- E. Install enclosure continuously from wall to wall.
- F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
- G. Install valves within reach of access door provided in enclosure.
- H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect hot-water finned-tube radiation heaters and components to piping according to Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties."
  - 1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.
- C. Connect steam finned-tube radiation heaters and components to piping according to Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Piping Specialties."
- D. Install control valves as indicated on drawings.
- E. Install piping adjacent to finned-tube radiation heaters to allow service and maintenance.
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238236



## SECTION 238239 - CABINET UNIT HEATERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes cabinet unit heaters with centrifugal fans and hot-water coils.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Location and size of each field connection.
  - 3. Location and arrangement of piping valves and specialties.
  - 4. Location and arrangement of integral controls.
  - 5. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which cabinet unit heaters will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
  - 6. Perimeter moldings for exposed or partially exposed cabinets.
- D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

- E. Samples for Verification: Finish colors for each type of cabinet unit heater indicated with factory-applied color finishes.
- F. Manufacturer Seismic Qualification Certification: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC piping and Equipment." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Cabinet Unit Heater Filters: Furnish 1 spare filter for each filter installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURED UNITS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Trane.
  2. Sterling.
  3. Carrier Corporation.
  4. Markel Products; a division of TPI Corporation.
  5. Marley Electric Heating; a division of Marley Engineered Products.
  6. QMark Electric Heating; a division of Marley Engineered Products.
  7. Or Approved Equal.
- D. Description: A factory-assembled and -tested unit complying with ARI 440.
1. Comply with UL 2021.
- E. Coil Section Insulation: ASTM C 1071; surfaces exposed to air stream shall be aluminum-foil facing to prevent erosion of glass fibers.
1. Thickness: 1/2 inch / 1 inch.
  2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F (0.037 W/m x K at 24 deg C) mean temperature.
  3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
  4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
- F. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Owner/Architect.
1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch-thick, galvanized, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  2. Recessing Flanges: Steel, finished to match cabinet.
  3. Control Access Door: Key operated.
    - a. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with electronic, two-position actuators.
- G. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Washable Foam: 70 percent arrestance and 3 MERV.
  2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
  3. Pleated: 90 percent arrestance and 7 MERV.
- H. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
- I. Fan and Motor Board: Removable.
1. Fan: Forward curved, double width; directly connected to ECM motor. Aluminum or galvanized-steel fan scrolls.
  2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

- J. Factory, Hot-Water Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet and outlet.
1. Three-way, modulating control valve. Three-way valve packages shall include bypass line with manually adjustable balance device.
  2. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
  3. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
  4. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) threaded pipe and full-port ball valve in strainer drain connection.
  5. Wrought-Copper Unions: ASME B16.22.
- K. Control devices and operational sequences are specified in Division 23 Sections "HVAC Instrumentation and Controls."
- L. Unit Controls:
1. Factory installed/field installed controller shall be provided by mechanical contractor and installed by DDC subcontractor.
- M. Electrical Connection: Factory wire motors and controls for a single field connection.
- N. Capacities and Characteristics:
1. Fan:
    - a. Airflow: See drawings.
    - b. External Static Pressure: See drawings.
    - c. Motor Horsepower: See drawings.
  2. Heating Capacity:
    - a. Output: See drawings.
    - b. Entering-Air Temperature: See drawings.
    - c. Air-Temperature Rise: See drawings.
  3. Hot-Water Heating Coil:
    - a. Water Flow: See drawings.
    - b. Water-Side Pressure Loss: See drawings.
    - c. Entering-Water Temperature: See drawings.
  4. Filters:
    - a. Thickness: 1 inch.



5. Electrical Characteristics for Single-Point Connection:

- a. Volts: See drawings.
- b. Phase: See drawings.
- c. Hertz: See drawings.
- d. Full-Load Amperes: See drawings.

2.2 CABINET HEATERS:

- A. Performance Data: Capacity – Unit capacities shall be in accordance with Industry Room Fan-Coil Air-Conditioner Certification Program under ARI Standard 440-97. Safety – All standard units shall be UL listed. Units shall comply with NFPA90A requirements.
- B. All Units – The unit shall include a chassis, coil, fan wheel(s), fan casing(s), fan board and motor(s). The fan board assembly shall be easily removable. The fan board assembly shall include a quick-disconnect motor plug. The chassis construction shall be 18-gauge galvanized steel, and continuous throughout the unit. The unit shall be acoustically and thermally insulated with closed-cell insulation. All panels shall be made rigid by channel forming.
- C. Vertical Cabinet Units: Front panel fabrication shall be 16-gauge galvanized steel. All other panels shall be 18-gauge galvanized steel. Hinged access door construction shall be 20-gauge steel and shall be flush with top panel.
- D. Unit Finish: All cabinet parts and exposed recessed panels shall be cleaned, bonderized, phosphatized, and painted with a baked powder finish available in six decorator colors. Standard finish meets ASTM B117 specifications (salt spray test).
- E. Fans – The galvanized metal fan wheels shall be centrifugal forward-curved and double-width. Fan wheels and housings shall be corrosion resistant. Fan housing construction shall be formed sheet metal.
- F. Motors – All motors shall be brushless DC (BLDC)/electronically commutated motors (ECM) factory-programmed and run-tested in assemblies units. The motor controller shall be mounted in a touch-safe control box with a built-in integrated user interface and LED tachometer. If adjustments shall be needed, motor parameters can be adjusted through momentary contact switches accessible without factory service personnel on the motor control board.

Motors shall soft-ramp between speeds to lessen the acoustics due to sudden speed changes. Motors shall be operated at three speeds or with a field-supplied variable speed controller. The motor shall choose the highest speed if there are simultaneous/conflicting speed requests.

All motors shall have integral thermal overload protection with a maximum ambient operating temperature of 104°F and shall be permanently lubricated. Motors shall be capable of starting at 50 percent protection with a maximum ambient operating temperature of 104 F and shall be permanently lubricated. Motors shall be capable of starting at 78 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors shall be able to operate up to 10 percent over voltage.

- G. Control Interface: The control interface shall be intended to be used with a field-supplied, low-voltage thermostat or controller. The control box shall contain a relay board which shall include a line voltage to 24-volt transformer, and an optional disconnect switch. All end devices shall be wired to a low-voltage terminal block and shall be run-tested, so the only a power connection

and thermostat/controller connection shall be needed to commission the unit. Changeover sensors and controls shall be provided whenever a change-over coil is selected. When N.O. valves are selected, inverting relays shall be provided for use with standard thermostats.

- H. Fan Speed Switch: The fan speed switch shall be available with or without the control interface option and shall be available as unit-mount. The unit-mount FSS shall employ low-voltage fan switches. However, the low-voltage fan speed option shall provide an interface to factory wiring, including variable-speed/high-medium-low (HML) control. The control box shall contain a line voltage to 24-volt transformer, ECM motor controller, and an optional disconnect switch.
- I. Hot Water Coils – Hot water coils shall be proof-tested at 350 psig (air under water) and leak tested at 125 psig (air under water). Maximum main coil working pressure shall be 300 psig. Maximum entering water temperature shall be 200 F. Tubes and u-bends shall be 3/8" (10 mm) OD copper. Fins are aluminum and shall be mechanically bonded to the copper tubes. Coil stubouts shall be 5/8" (16 mm) OD copper tubing.
- J. Piping Packages (Hot Water Coils) – All piping packages shall be proof-tested at 350 psig (air under water) and leak tested at 125 psig (air under water). The maximum working pressure of the interconnecting piping shall be 300 psig.

Piping package shall be deluxe configuration. The deluxe package shall include unions at the coil connections and a 20-mesh strainer on the supply side with a pressure rating on the strainer of up to 400 psig.

End valve options on the piping package shall include ball valves, manual circuit setters, and auto circuit setters.

- K. Ball Valve S&R, Auto Circuit Setter Return – Ball-type end valves shall be mounted on the supply and return, with an additional auto circuit setter mounted on the return. The auto circuit setter shall be an automatic flow control valve that shall be sized to allow a specific GPM through the coil. Auto circuit setters shall include two P/T plugs and have a maximum working pressure of 400 psig.
- L. Modulating Control Valves - Three-way modulating valves shall be rated for a maximum 50 psig pressure differential across the valve.
- M. Filters – Filters shall be concealed from sight and easily removable. Filters shall be located behind an integral access door on horizontal-type units. Filters shall be either 1" throwaway or 1" pleated media throwaway. Pleated media filters shall be Farr 30/30.
- N. Auto Two-Position Damper – The auto two-position damper is factory set at 25 percent when open. The damper shall be set in the field to allow from zero to 50 percent fresh air.
- O. Options:
  - 1. Disconnect Switch – A unit-mounted disconnect switch shall be available as a standard option on all units.
  - 2. Colors – Six decorator colors shall be available in a baked powder finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before cabinet unit heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 7 Section "Joint Sealants."
- B. Install cabinet unit heaters to comply with NFPA 90A.
- C. Suspend cabinet unit heaters from structure with elastomeric hangers and seismic restraints. Vibration isolators and seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.
- E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
- D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Duct Accessories."
- E. Comply with safety requirements in UL 1995.
- F. Ground equipment according to Division 26 Section "Grounding and Bonding."
- G. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.5 ADJUSTING

- A. Adjust initial temperature set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 1.

END OF SECTION 238239

## SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

#### 1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

- E. Coordinate with asbestos abatement plans and specifications and with abatement contractor for all work that potentially will disturb asbestos.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to manufacturers specified or approved equal.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.

### 2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements.
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or approved equal.
  - 3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 4. Pressure Plates: Plastic. Include two for each sealing element.

5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500



## SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
  - 1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

#### 1.5 PRODUCT DELIVERY

- A. Mark and tag insulated conductors and cables for delivery to site. Include the following:
  - 1. Contractor's name.
  - 2. Project title and number.
  - 3. Date of manufacture (month & year).
  - 4. Manufacturer's name.
  - 5. Data which explains the meaning of coded identification (UL assigned electrical reference numbers, UL assigned combination of color marker threads, etc.).
  - 6. Environmental suitability information (listed or marked "sunlight resistant" where exposed to direct rays of sun; wet locations listed/marked for use in wet locations; other applications listed/marked suitable for the applications).

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 CONDUCTORS AND CABLES

- A. Manufacturers
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Pirelli Cable Corp
  - 5. Senator Wire & Cable Company.
  - 6. Southwire Company.
  - 7. Or Approved Equal.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, USE and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC; metal-clad cable, Type MC; mineral-insulated, metal-sheathed cable, Type MI; Type SO and Type USE with ground wire.
- E. Electric Light and Power Wiring:
  - a. General: Rated 600V, NFPA 70 Type THHN/THWN-2 or XHHW-2.

- b. THHN/THWN-2 Gasoline and Oil Resistant: Polyvinylchloride insulation rated 600 V with nylon jacket conforming to UL requirements for type THHN/THWN-2 insulation, with the words "GASOLINE AND OIL RESISTANT II" marked thereon.
- c. USE-2: Dual rated heat and moisture resistant insulation rated 600 V with jacket or dual-purpose insulation/protective covering conforming to UL requirements for type USE-2 service entrance cables.
- d. Metal-Clad Cable, NFPA 70 Article 330 Type MC:
  - 1) Interlocked flexible galvanized steel armor sheath, conforming to UL requirements for type MC metal clad cable.
  - 2) Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 Table 310.13(A) or of a type identified for use in Type MC cable.
  - 3) Internal full-size copper ground conductor with green insulation.
  - 4) Acceptable Companies: AFC Cable Systems Inc., Southwire, General Cable.
  - 5) Connectors for MC cable: AFC Fitting Inc.'s AFC Series, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.

## 2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. Illsco Corp
  - 4. O-Z/Gedney; EGS Electrical Group LLC.
  - 5. Penn Union
  - 6. 3M; Electrical Products Division.
  - 7. Tyco Electronics Corp.
  - 8. Thomas & Betts
  - 9. Or Approved Equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.4 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.5 SLEEVE SEALS

- A. Manufacturers:
  - 1. Advance Products & Systems, Inc.

2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Or Approved Equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two (2) for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 CONNECTORS

1. Connectors specified are part of a system. Furnish connectors and components, and use specific tools and methods as recommended by connector manufacturer to form complete connector system.
2. Connectors shall be UL 486 A listed, or UL 486 B listed for combination dual rated copper/aluminum connectors (marked AL7CU for 75 degrees C rated circuits and AL9CU for 90 degrees C rated circuits).
3. Spring Type:
  - a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s B-Cap, Electrical Products Div./3M's Scotchlok Type Y, R, G, B, O/B+, R/Y+, or B/G+, Ideal Industries Inc.'s Wing Nuts or Wire Nuts or approved equal.
  - b. Rated 150° C, 600V; Ideal Industries Inc.'s High Temperature Wire-Nut Model 73B, 59B.
4. Indent Type with Insulating Jacket:
  - a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s Crimp Connectors, Ideal Industries Inc.'s Crimp Connectors, Penn-Union Corp.'s Penn-Crimps, or Thomas & Betts Corp.'s STA-KON or approved equal.
5. Indent Type (Uninsulated): Anderson/Hubbell's Versa-Crimp, VERSAtile, Blackburn/T&B Corp.'s Color-Coded Compression Connectors, Electrical Products Div./3M's Scotchlok 10000, 11000 Series, Burndy's Hydent, Penn-Union Corp.'s BCU, BBCU Series, or Thomas & Betts Corp.'s Compression Connectors or approved equal.
6. Connector Blocks: NIS Industries Inc.'s Polaris System, or Thomas & Betts Corp.'s Blackburn AMT Series or approved equal.
7. Resin Splice Kits: Electrical Products Div./3M's Scotchcast Brand Kit Nos. 82A Series, 82-B1 or 90-B1, or Scotchcast Brand Resin Pressure Splicing Method or approved equal.
8. Heat Shrinkable Splices: Electrical Products Div./3M's ITCSN, Raychem Corp.'s Thermofit Type WCS, or Thomas & Betts Corp.'s SHRINK-KON Insulators or approved equal.
9. Cold Shrink Splices: Electrical Products Div./3M's 8420 Series or approved equal.
10. Single Cable (Compression Type Lugs): Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, Electrical Products Div./3M Scotchlok 31036 or 31145 Series, Ideal

Industries Inc.'s CCB or CCBL, NSI Industries Inc.'s L, LN Series, Penn-Union Corp.'s BBLU Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.

11. Single Cable (Mechanical Type Lugs): Copper, one or 2 hole style (to suit conditions); Blackburn/T&B Corp.'s Color-Keyed Locktite Series, Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Locktite Series or approved equal.
12. Multiple Cable (Mechanical Type Lugs): Copper, configuration to suit conditions; Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Color-Keyed Locktite Series or approved equal.

## 2.5 TAPES

- A. Plastic Tape: Electrical Products Div./3M's Scotch Super 33+ or Scotch 88, Plymouth Rubber Co.'s Plymouth/ Bishop Premium 85CW or approved equal.
- B. Rubber Tape: Electrical Products Div./3M's Scotch 130C, or Plymouth Rubber Co.'s Plymouth/Bishop W963 Plysafe or approved equal.
- C. Moisture Sealing Tape: Electrical Products Div./3M's Scotch 2200 or 2210, or Plymouth Rubber Co.'s Plymouth/Bishop 4000 Plyseal-V.
- D. Electrical Filler Tape: Electrical Products Div./3M's Scotchfil, or Plymouth Rubber Co.'s Plymouth/Bishop 125 Electrical Filler Tape.
- E. Arc Proofing Tapes:
  1. Arc Proofing Tape: Electrical Products Div./3M's Scotch 77, Mac Products Inc.'s AP Series, or Plymouth Rubber Co.'s Plymouth/Bishop 53 Plyarc or approved equal.
  2. Glass Cloth Tape: Electrical Products Div./3M's Scotch 27/Scotch 69, Mac Products Inc.'s TAPGLA 5066, or Plymouth Rubber Co.'s Plymouth/Bishop 77 Plyglas or approved equal.
  3. Glass-Fiber Cord: Mac Products Inc.'s MAC 0527 or approved equal.

## 2.6 TAGS

1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.

## 2.7 WIRE MANAGEMENT PRODUCTS

- A. Clamps and Clips, Cable Ties, Spiral Wraps, Etc: Catamount/T&B Corp., or Ideal Industries Inc. or approved equal.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN or Type XHHW, single conductors in raceway .
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway;; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

### 3.7 INSTALLATION

- A. conductors in raceways after the raceway system is completed. Exceptions: Type MC, MI, or other type specifically indicated on the drawings not to be installed in raceways.

- B. No grease, oil, or lubricant other than wire-pulling compounds specified may be used to facilitate the installation of conductors.

### 3.8 CIRCUITING

- A. Do not change, group or combine circuits other than as indicated on the drawings.

### 3.9 COMMON NEUTRAL CONDUCTOR

- A. A common neutral may be used for 2 or 3 branch circuits where the circuits are indicated on the drawings to be enclosed within the same raceway, provided each branch circuit is connected to different phase busses in the panelboard.
- B. Exceptions - The following circuits shall have a separate neutral:
  - 1. Circuits containing ground fault circuit interrupter devices.
  - 2. Circuits containing solid state dimmers.
  - 3. Circuits recommended by equipment manufacturers to have separate neutrals.

### 3.10 CONDUCTOR SIZE

- A. Conductor Size:
  - 1. For Electric Light and Power Branch Circuits: Install conductors of size shown on drawings. Where size is not indicated, the minimum size allowed is No. 12 AWG.
  - 2. For Class 1 Circuits:
    - a. No. 18 and No. 16 AWG may be used provided they supply loads that do not exceed 6 amps (No. 18 AWG), or 8 amps (No. 16 AWG).
    - b. Larger than No. 16 AWG: Use to supply loads not greater than the ampacities given in NFPA 70 Section 310.15.
  - 3. For Class 2 Circuits: Any size to suit application.
  - 4. For Class 3 Circuits: Minimum No. 18 AWG.

### 3.11 COLOR CODING

- A. Color Coding for 120/208 Volt Electric Light and Power Wiring:
  - 1. Color Code:
    - a. 2 wire circuit - black, white.
    - b. 3 wire circuit - black, red, white.
    - c. 4 wire circuit - black, red, blue, white.
  - 2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.
    - a. "White" for Sizes No. 6 AWG or Smaller:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length.
    - b. "White" for Sizes Larger Than No. 6 AWG:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length, or:



- 3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
3. Colors (Black, Red, Blue):
  - a. For Branch Circuits: Continuous color outer finish.
  - b. For Feeders:
    - 1) Continuous color outer finish, or:
    - 2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutter, pullboxes, and manholes.
- B. Color Coding For 277/480 Volt Electric Light and Power Wiring:
  1. Color Code:
    - a. 2 wire circuit – brown, gray.
    - b. 3 wire circuit – brown, yellow, gray.
    - c. 4 wire circuit – brown, yellow, orange, gray.
  2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase to phase circuits.
    - a. "Gray" For Sizes No. 6 AWG or Smaller.
      - 1) Continuous gray outer finish.
    - b. "Gray" For Sizes Larger Than No. 6 AWG:
      - 1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
    - c. Colors (Brown, Yellow, Orange):
    - d. For Branch Circuits: Continuous color outer finish.
    - e. For Feeders:
      - 1) Continuous color outer finish, or:
      - 2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
- C. More Than One Nominal Voltage System Within A building: Permanently post the color coding scheme at each branch-circuit panelboard.
- D. Existing Color Coding Scheme: Where an existing color coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.
- E. Color Code For Wiring Other Than Electric Light and Power: In accordance with ICEA standard S-73-532 (NEMA WC57-2004). Other coding methods may be used, as approved.

### 3.12 IDENTIFICATION

- A. Identification Tags: Use tags to identify feeders and designated circuits. Install tags so that they are easily read without moving adjacent feeders or requiring removal of arc proofing tapes. Attach tags with non-ferrous wire or brass chain.
  1. Interior Feeders: Identify each feeder in pullboxes and gutters. Identify by feeder number and size.

2. Exterior Feeders: Identify each feeder in manholes and in interior pullboxes and gutters. Identify by feeder number and size, and also indicate building number and panel designation from which feeder originates.
  3. Street and Grounds Lighting Circuits: Identify each circuit in manholes and lighting standard bases. Identify by circuit number and size, and also indicate building number and panel designation from which circuit originates.
- B. Identification Plaque: Where a building or structure is supplied by more than one service, or has any combination of feeders, branch circuits, or services passing through it, install a permanent plaque or directory at each service, feeder and branch circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

### 3.13 WIRE MANAGEMENT

- A. Use wire management products to bundle, route, and support wiring in junction boxes, pullboxes, wireways, gutters, channels, and other locations where wiring is accessible.

### 3.14 EQUIPMENT GROUNDING CONDUCTOR

- A. Install equipment grounding conductor:
1. Where specified in other Sections or indicated on the drawings.
  2. In conjunction with circuits recommended by equipment manufacturers to have equipment grounding conductor.
- B. Equipment grounding conductor is not intended as a current carrying conductor under normal operating circumstances.
- C. Color Coding For Equipment Grounding Conductor:
1. Color Code: Green.
  2. "Green" For sizes No. 6 AWG or Smaller:
    - a. Continuous green outer finish, or:
    - b. Continuous green outer finish with one or more yellow stripes, or:
    - c. Bare copper (see exception below).
  3. "Green" For Sizes Larger Than No. 6:
    - a. Stripping the insulation or covering from the entire exposed length (see exception below).
    - b. Marking the exposed insulation or covering with green color coding tapes.
    - c. Identify at each end and at every point where the equipment grounding conductor is accessible.
  4. Exception For use of Bare Copper: Not allowed for use where NFPA 70 specifically requires equipment grounding conductor to be insulated, or where specified in other Sections or indicated on the drawings to be insulated.

### 3.15 ARC PROOFING

- A. Where indicated on the drawings, arc proof feeders installed in a common pullbox or manhole as follows:
1. Arc proof new feeders.
  2. Arc proof existing feeders that are spliced to new feeders.

3. Arc proof each feeder as a unit (except feeders consisting of multiple sets of conductors).
4. Arc proof feeders consisting of multiple sets of conductors by arc proofing each set of conductors as a unit.
5. Arc proof feeders with half-lapped layer of 55 mils thick arc proofing tape and random wrapped or laced with glass cloth tape or glass-fiber cord. For arc proofing tape less than 55 mils thick, add layers to equivalent of 55 mils thick arc proofing tape.

### 3.16 INSULATED CONDUCTOR AND CABLE SCHEDULE - TYPES AND USE

#### A. Electric Light and Power Circuits:

1. Type THHN/THWN-2 or XHHW-2: Wiring in dry or damp locations (except where special type insulation is required).
2. THHN/THWN-2 or XHHW-2: Wiring in wet locations.
3. THHN/THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).
4. THHN/THWN-2 or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.
5. THHN/THWN-2 Marked "Gasoline and Oil Resistant": Wiring to gasoline and fuel oil pumps.
6. MC:
  - a. Branch circuit wiring in wood framed construction (wood joists and wood stud partitions):
    - 1) Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
    - 2) Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
    - 3) Do not attach the conductors to the edge of joists or studs.
  - b. Branch circuit wiring in movable metal partitions and movable gypsum partitions.
    - 1) Install conductors in accordance with partition manufacturer's recommendations.
  - c. Branch circuit wiring in metal stud partitions:
    - 1) Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
    - 2) Install conductors through holes bored in the center of the metal member when running at right angles to studs.
      - a) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.

#### B. Emergency Feeder Circuits: Use electrical circuit protective system.

#### C. Class 1 Circuits: Use Class 1 wiring specified in Part 2 (except where special type insulation is required).

#### D. Class 2 Circuits: Use Class 2 wiring specified in Part 2 (except where special type insulation is required).

#### E. Class 3 Circuits: Use Class 3 wiring specified in Part 2 (except where special type insulation is required).

### 3.17 CONNECTOR SCHEDULE - TYPES AND USE

#### A. Temperature Rating: Use connectors that have a temperature rating, equal to, or greater than the temperature rating of the conductors to which they are connected.

B. Splices:

1. Dry Locations:

- a. For Conductors No. 8 AWG or Smaller: Use spring type pressure connectors, indent type pressure connectors with insulating jackets, or connector blocks (except where special type splices are required).
  - b. For Conductors No. 6 AWG or Larger: Use connector blocks or uninsulated indent type pressure connectors. Fill indentions in uninsulated connectors with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with heat shrinkable splices or cold shrink splices.
  - c. Gutter Taps in Panelboards: For uninsulated type gutter taps fill indentions with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with gutter tap cover.
2. Damp Locations: As specified for dry locations, except apply moisture sealing tape over the entire insulated connection (moisture sealing tape not required if heat shrinkable splices or cold shrink splices are used).
3. Wet Locations: Use uninsulated indent type pressure connectors and insulate with resin splice kits, cold shrink splices or heat shrinkable splices. Exception: Splices above ground which are totally enclosed and protected in NEMA 3R, 4, 4X enclosures may be spliced as specified for damp locations.

C. Terminations:

1. For Conductors No. 10 AWG or Smaller: Use terminals for:
  - a. Connecting wiring to equipment designed for use with terminals.
2. For Conductors No. 8 AWG or Larger: Use compression or mechanical type lugs for:
  - a. Connecting cables to flat bus bars.
  - b. Connecting cables to equipment designed for use with lugs.
3. For Conductor Sizes Larger Than Terminal Capacity On Equipment: Reduce the larger conductor to the maximum conductor size that terminal can accommodate (reduced section not longer than one foot). Use compression or mechanical type connectors suitable for reducing connection.

END OF SECTION 260519

## SECTION 260523 – CONTROL-VOLTAGE ELECTRICAL POWER CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Low-voltage control cabling.
  - 2. Control-circuit conductors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Source quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### PART 2 - PRODUCTS

#### 2.1 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

#### 2.2 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway.

- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps if possible.
- C. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets and terminals.
  - 2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.
  - 3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.
  - 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 5. Pulling Cable: Monitor cable pull tensions.
- C. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- D. Open-Cable Installation:
  - 1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
  - 2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

### 3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables made obsolete by this contract.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

#### A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

### 3.5 FIRESTOPPING

- #### A. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.6 GROUNDING

- #### A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.7 IDENTIFICATION

- #### A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.8 FIELD QUALITY CONTROL

- #### A. Perform tests and inspections.

#### B. Tests and Inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.

END OF SECTION 260523





## SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Ground rods.
  - 2. Grounding arrangements and connections for separately derived systems.
  - 3. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems based on NETA MTS.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Ground Clamps (Cable to Pipe): Blackburn/T&B Corp.'s GUV, Burndy's GAR, GD, GP, GK, or OZ/Gedney Co.'s ABG, CG or approved equal.
- B. Ground Clamps (Cable to Rod): Blackburn/T&B Corp.'s GG, GGH, JAB, GUV, Burndy's GP, GX, GRC, or OZ/Gedney Co.'s ABG or approved equal.
- C. Ground Lugs: Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, 3M Scotchlok 31036 or 31145 Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.
- D. Exothermic Type Weld: Erico Inc.'s Cadweld Process, or Furseweld/T&B Corp.'s Exothermic Welding System or approved equal.
- E. Compression Connectors: Amp Inc.'s Ampact Copper Grounding System, or Burndy's Hyground System or approved equal.
- F. Rod Electrodes: Copper clad (minimum .010 jacket) ground rods minimum 5/8 inches diameter by 8'-0" long.
- G. Plate Electrodes: Copper plates minimum 0.06 inches thick by 2'-0" square feet of surface area.
- H. Grounding Electrode Conductors and Bonding Conductors: Copper conductors, bare or insulated with THW, THW-2, XHHW, XHHW-2, THWN, THWN-2 or THHN insulation.
- I. Hardware: Silicon-bronze bolts, nuts, flat and lock washers etc. as manufactured by Burndy, or OZ/Gedney Co. or approved equal.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

- 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

## 2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 by 96 inches minimum in diameter. Chemical-Enhanced Grounding Electrodes shall not be used.
- B. Building steel.
- C. Underground water pipe.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
- D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  1. Feeders and branch circuits.
  2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
  8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 75 feet apart.

### 3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
  - 1. Division 26 Section "Vibration and Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:

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#4.1092.72.03

1. Steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  1. Trapeze hangers. Include Product Data for components.
  2. Steel slotted channel systems. Include Product Data for components.
  3. Equipment supports.
- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  1. Manufacturers:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
    - h. Or Approved Equal.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  5. Channel Dimensions: Selected for applicable load criteria.



- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Manufacturers:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
    - e. Or Approved Equal.
  2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
      - 6) Or Approved Equal.
  2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  5. Toggle Bolts: All-steel springhead type.
  6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports where permitted by signed and sealed shop drawings.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 where permitted by signed and sealed shop drawings.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
  6. To Light Steel: Sheet metal screws.
  7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529



## SECTION 260532 – INTERIOR RACEWAYS, FITTINGS, AND ACCESSORIES

### PART 1 - GENERAL

#### 1.01 REFERENCES

- A. NFPA, NEMA, ANSI, and UL.

#### 1.02 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions.

### PART 2 - PRODUCTS

#### 2.01 RACEWAYS

- A. Rigid Ferrous Metal Conduit: Steel, hot dipped galvanized on the outside and inside, UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit - Steel or Rigid Steel Conduit), by Allied Tube & Conduit Corp., Republic Conduit, or Wheatland Tube Co. or approved equal.
- B. Intermediate Ferrous Metal Conduit: Steel, galvanized on the outside and enameled on the inside, UL categorized as Intermediate Ferrous Metal Conduit (identified on UL Listing Mark as Intermediate Metal Conduit or IMC), by Allied Tube & Conduit Corp., Republic Conduit, or Wheatland Tube Co. or approved equal.
- C. Electrical Metallic Tubing: Steel, galvanized on the outside and enameled on the inside, UL categorized as Electrical Metallic Tubing (identified on UL Listing Mark as Electrical Metallic Tubing), by Allied Tube & Conduit Corp Republic Conduit, or Wheatland Tube Co. or approved equal.
- D. Flexible Metal Conduit: Galvanized steel strip shaped into interlocking convolutions, UL categorized as Flexible Metal Conduit (identified on UL Listing Mark as Flexible Steel Conduit or Flexible Steel Conduit Type RW), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or International Metal Hose Co. or approved equal.
- E. Liquid-tight Flexible Metal Conduit: UL categorized as liquid-tight flexible metal conduit (identified on UL Listing Mark as Liquid-Tight Flexible Metal Conduit, also specifically marked with temperature and environment application data), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or Universal Metal Hose Co. or approved equal.
- F. Wireways, Fittings and Accessories:
  - 1. NEMA 1 (Without Knockouts): Square D Co.'s Class 5100, Cooper B-Line, Hubbell/Wiegmann's HS Series or equivalent as manufactured by Pentair/Hoffman or approved equal.

#### 2.02 FITTINGS AND ACCESSORIES

- A. Insulated Bushings:
  - 1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated throat; Appleton Electric Co.'s BU50I Series, Cooper/Crouse-Hinds' 1031 Series, OZ/Gedney Co.'s IBC-50 Series, Raco Inc.'s 1132 Series, Steel City/T & B Corp.'s BI-901 Series, or Thomas & Betts Corp.'s 1222 Series or approved equal.

2. Threaded malleable iron with 150 degrees C plastic throat; Appleton Electric Co.'s BU501 Series, Cooper/Crouse-Hinds' H1031 Series, or OZ/Gedney Co.'s IBC-50 Series or approved equal.
- B. Plastic Bushings for 1/2 and 3/4 Inch Conduit:
1. 105 degrees C minimum temperature rating; Appleton Electric Co.'s BBU50, BBU75, Blackburn (T & B Corp.'s) 50 BB, 75 BB, Cooper/Crouse-Hinds' 931,932, or OZ/Gedney Co.'s IB-50, IB-75, Racco Inc.'s 1402, 1403, Steel City/T & B Corp.'s BU-501, BU-502, or Thomas & Betts Corp.'s 222, 223 or approved equal.
  2. 150 degrees C temperature rating; Appleton Electric Co.'s BBU50H, BBU75H, Cooper/Crouse-Hinds' H-931, H-932, or OZ/Gedney Co.'s A-50, A-75, or approved equal.
- C. Insulated Grounding Bushings:
1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB-50 Series, Cooper/Crouse-Hinds' GLL Series, OZ/Gedney Co.'s IBC-50L Series, Racco Inc.'s 1212 Series, Steel City/T & B Corp.'s BG-801 (1/2 to 2") Series, or Thomas & Betts Corp.'s 3870 or approved equal.
  2. Threaded malleable iron/zinc electroplate with 150 degrees C plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB Series, Cooper/Crouse-Hinds' HGLL Series, or OZ/Gedney Co.'s IBC-50L Series, or Thomas & Betts Corp.'s 3870 or approved equal.
- D. Connectors and Couplings:
1. Locknuts: UL, steel/zinc electroplate; Appleton Electric Co.'s BL-50 Series, Cooper/Crouse-Hinds' 11 Series, OZ/Gedney Co.'s 1-50S Series, Racco Inc.'s 1002 Series, Steel City/T&B Corp.'s LN-101 Series, or Thomas & Betts Corp.'s 141 Series or approved equal.
  2. Grounding Wedge: Thomas & Betts Corp.'s 3650 Series or approved equal.
  3. Couplings for Rigid Metal and IMC Conduit: Standard galvanized threaded couplings as furnished by conduit manufacturer, Allied Tube & Conduit Corp.'s Kwik-Couple, or Thomas & Betts Corp.'s Shamrock or approved equal.
  4. Three Piece Conduit Coupling For Rigid Metal and IMC Conduit: Steel, malleable iron, zinc electroplate; Allied Tube & Conduit Corp.'s Kwik-Couple, Appleton Electric Co.'s EC-50 Series, Cooper/Crouse-Hinds' 190M Series, OZ/Gedney Co.'s 4-50 Series, Racco Inc.'s 1502 Series, Steel City/T & B Corp.'s EK-401 Series, or Thomas & Betts Corp.'s 675 Series or approved equal.
  5. Electrical Metallic Tubing Couplings and Insulated Connectors: Compression type, steel/zinc electroplate; Appleton Electric Co.'s TW-50CS1, TWC-50CS Series, Cooper/Crouse-Hinds' 1650, 660S Series, Racco Inc.'s 2912, 2922 Series, Steel City/T & B Corp.'s TC-711 Series, or Thomas & Betts Corp.'s 5120, 5123 Series or approved equal.
  6. Flexible Metal Conduit Connectors: Arlington Industries Inc.'s Saddle-Grip, OZ/Gedney Co.'s C-8T, 24-34T, ACV-50T Series, or Thomas & Betts Corp.'s Nylon Insulated Tite-Bite Series or approved equal.
  7. Liquid-tight Flexible Metal Conduit Connectors: Steel, malleable iron, zinc electroplate, insulated throat; Appleton Electric Co.'s STB Series, Cooper/Crouse-Hinds' LTB Series, OZ/Gedney Co.'s 4Q-50T Series, Racco Inc.'s 3512 Series, Steel City/T & B Corp.'s LT-701 Series, or Thomas & Betts Corp.'s 5332 Series or approved equal.
- E. Conduit Bodies (Threaded):
1. Malleable Iron/Zinc Electroplate: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds'

Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies or approved equal.

F. Expansion Fittings:

1. Malleable Iron, Zinc Electroplate Finish: Appleton Electric Co.'s XJ or OZ/Gedney Co.'s AX (TX for EMT), with external bonding jumper or approved equal.
2. Electrogalvanized Steel: Cooper/Crouse-Hinds' XJG (XJG-EMT for EMT), or Thomas & Betts Corp.'s XJG, with internal grounding or approved equal.

G. Deflection Fittings: Appleton Electric Co.'s DF, Cooper/Crouse-Hinds' XD, or OZ/Gedney Co.'s Type DX or approved equal.

H. Sealant for Raceways Exposed to Different Temperatures: Sealing compounds and accessories to suit installation; Appleton Electric Co.'s DUC, or Kwiko Sealing Compound with fiber filler, Cooper/Crouse-Hinds' Chico A Sealing Compound with Chico X fiber, Electrical Products Division 3M Scotch products, OZ Gedney Co.'s DUX or EYC sealing compound with EYF damming fiber, or Thomas & Betts Corp.'s Blackburn DX or approved equal.

I. Vertical Conductor Supports: Kellems/Hubbell Inc.'s Conduit Riser Grips, or OZ/Gedney Co.'s Type M, Type R or approved equal.

J. Pulling-In-Line for Installation in Spare and Empty Raceways: Polypropylene monofilament utility line; Greenlee Textron Inc.'s Poly Line 430, 431, or Ideal Industries Powr-Fish Pull-Line 31-340 Series or approved equal.

## PART 3 - EXECUTION

### 3.01 RACEWAY INSTALLATION - GENERAL

A. Number of Raceways: Do not change number of raceways to less than the number indicated on the drawings.

1. Each raceway shall enclose one circuit unless otherwise indicated on the drawings.

B. Raceways for Future Use (Spare Raceways and Empty Raceways): Draw fish tape through raceways in the presence of the Director's Representative to show that the raceway is clear of obstructions.

1. Leave a pulling-in line in each spare and empty raceway.

C. Conduit Installed Concealed:

1. Install conduit concealed unless otherwise indicated on the drawings.

2. New Construction:

- a. Run conduit in the ceilings, walls, and partitions.
- b. Install conduit in concrete slabs, under slabs on grade, or under slabs above finished ceilings where indicated on the drawings. Concrete slabs that are both ceilings and floors shall be treated as floor slabs.
  - 1) Conduit in Slab: Run 3/4 inch conduit in the slab where placement of reinforcement and slab thickness is sufficient to allow 1-1/2 inches of concrete cover over conduit, otherwise run conduit under slab. Run conduit one inch and larger in the slab in the specific location(s) where it is indicated on the drawing to be run in the slab, otherwise run conduit under slab.

- a) Run conduit under reinforcement where reinforcement is in upper portion or middle of slab.
    - b) Run conduit over reinforcement where reinforcement is in lower portion of slab.
    - c) Run conduit between reinforcement where reinforcement is in upper and lower portions of slab.
    - d) Separate parallel conduits minimum of 2 inches so that each conduit will be enveloped in concrete.
    - e) Pass conduit over steel beams, if any, parallel with the reinforcement.
    - f) Tie down conduit to avoid movement during placement of concrete.
    - g) Demonstrate to the Director's Representative that conduit has been placed to allow minimum of 1-1/2 inches of concrete cover.
  - 2) Conduit Under Slab on Grade:
    - a) Run conduit under vapor barrier, if any.
    - b) Install equipment grounding conductor in each conduit. Bond at boxes and equipment to which conduit is connected.
  - 3) Conduit Under Slab, Above Finished Ceiling:
    - a) Attach conduit to bottom of slab or structure supporting the slab.
    - b) Firestop through-penetrations of the slab.
  - 3. If any portions of the conduit system cannot be installed concealed due to conditions encountered in the building, report such conditions and await approval in writing before proceeding.
- D. Conduits Penetrating Concrete Floor Slabs (Concrete slabs that are both ceilings and floors shall be treated as floor slabs):
- 1. Provide a minimum of 2 inches between conduits that vertically penetrate elevated concrete slabs.
  - 2. Provide firestopping and spray on fireproofing at locations where conduits penetrate surface of floor slab and slab is part of fire rating required for construction.
- E. Conduit Installed Exposed:
- 1. Install conduit exposed where indicated on the drawings.
  - 2. Install conduit tight to the surface of the building construction unless otherwise indicated or directed.
  - 3. Install vertical runs perpendicular to the floor.
  - 4. Install runs on the ceiling perpendicular or parallel to the walls.
  - 5. Install horizontal runs parallel to the floor.
  - 6. Do not run conduits near heating pipes.
  - 7. Installation of conduit directly on the floor will not be permitted.
- F. Conduit Size: Not smaller than 3/4 inch electrical trade size. Where type FEP, THHN, THWN, THWN-2, XHH, XHHW, or XHHW-2 conductors are specified for use under Section 260519, the minimum allowable conduit size for new Work shall be based on Type THW conductors.
- G. Conduit Bends: For 3/4 inch conduits, bends may be made with manual benders. For all conduit sizes larger than 3/4 inch, manufactured or field fabricated offsets or bends may be used. Make field fabricated offsets or bends with an approved hydraulic bender.



### 3.02 RACEWAY INSTALLATION - SPECIAL AREAS

- A. Raceways Exposed to Different Temperatures: Where portions of an interior raceway system are exposed to widely different temperatures, seal interior and exterior of raceway to prevent circulation of air from a warmer to a colder section through the raceway installation.
  - 1. Refrigerated Rooms: Install conduit body or junction box in the raceway system on warm side of refrigerated room. After conductors are installed, seal interior of the raceway at the conduit body or junction box.
  - 2. Heated Areas to Unheated Areas: After conductors are installed, seal interior of the raceway at the nearest conduit body, outlet or junction box in the heated area adjoining the unheated area.
- B. Conduit in Waterproofed Floors: Install conduit runs in waterproof floors to avoid penetrating the waterproofing. Avoid penetration of waterproofing with conduit risers so far as practicable.
  - 1. Where it is necessary to puncture the waterproofing for a conduit riser, install a standard weight steel pipe sleeve extending one inch above the finished floor level. Flash the steel pipe sleeve to the waterproofing with 16 ounce copper. Construct the flashing with a copper tube extending the full height of the sleeve, soldered to a copper base extending 6 inches in all directions from the sleeve.
  - 2. The flashing will be integrated into the waterproofing by the Construction Contractor. Provide solid cast brass floor plates with chromium finish where pipe sleeves are exposed in rooms.

### 3.03 RACEWAY SCHEDULE

- A. Rigid Ferrous Metal Conduit: Install in locations where specified or indicated on the drawings or referenced below.
  - 1. Boiler Room
  - 2. Rooftop equipment where conduit is exposed.
- B. Intermediate Ferrous Metal Conduit: May be installed in all dry and damp locations except:
  - 1. Where other type raceways are specified or indicated on the drawings.
- C. Electrical Metallic Tubing:
  - 1. May be installed concealed as branch circuit conduits above suspended ceilings where conduit does not support fixtures or other equipment.
  - 2. May be installed concealed as branch circuit conduits in hollow areas in dry locations, including:
    - a. Hollow concrete masonry units, except where cores are to be filled (use Rigid Metal Conduit).
    - b. Drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.
  - 3. May be installed exposed as branch circuit conduits in dry non-hazardous locations at elevations over 10'-0" above finished floor where conduit does not support fixtures or other equipment.

- D. Flexible Metal Conduit: Install equipment grounding conductor in the flexible metal conduit and bond at each box or equipment to which conduit is connected:
1. Use for final conduit connection to recessed lighting fixtures in suspended ceilings. Use 4 to 6 feet of flexible metal conduit, minimum size 1/2 inch, between junction box and fixture. Locate junction box at least 1 foot from fixture and accessible if the fixture is removed.
  2. Use 1 to 3 feet of flexible metal conduit for final conduit connection to:
    - a. Emergency lighting units.
    - b. Dry type transformers.
    - c. Motors with open, drip-proof or splash-proof housings.
    - d. Equipment subject to vibration (dry locations).
    - e. Equipment requiring flexible connection for adjustment or alignment (dry locations).
  3. May be installed concealed as branch circuit conduits in drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.
- E. Liquid-tight Flexible Metal Conduit: Install equipment grounding conductor in liquid-tight flexible metal conduit and bond at each box or equipment to which conduit is connected:
1. Use 1 to 3 feet of liquid-tight flexible metal conduit (UL listed and marked suitable for the installation's temperature and environmental conditions) for final conduit connection to:
    - a. Motors with weather-protected or totally enclosed housings.
    - b. Equipment subject to vibration (damp and wet locations).
    - c. Equipment requiring flexible connection for adjustment or alignment (damp and wet locations).
- F. Wireways: May be used indoors in dry locations for exposed raceway between grouped, wall mounted equipment.

### 3.04 FITTINGS AND ACCESSORIES SCHEDULE

A. General:

1. Use fittings and accessories that have a temperature rating equal to, or higher than the temperature rating of the conductors to be installed within the raceway.
2. Use zinc electroplate or hot dipped galvanized steel/malleable iron or cast iron alloy fittings and accessories in conjunction with ferrous raceways in dry and damp locations unless otherwise specified or indicated on the drawings.
3. Use insulated grounding bushings or grounding wedges on ends of conduit for terminating and bonding equipment grounding conductors, when required, if cabinet or boxes are not equipped with grounding/bonding screws or lugs.
4. Use caps or plugs to seal ends of conduits until wiring is installed to exclude foreign material.
5. Use insulated grounding bushings on the ends of conduits that are not directly connected to the enclosure, such as stub-ups under equipment, etc., and bond between bushings and enclosure with equipment grounding conductor.
6. Use expansion fittings where raceways cross expansion joints (exposed, concealed, buried).
7. Use deflection fittings where raceways cross expansion joints that move in more than one plane.
8. Use 2 locknuts and an insulated bushing on end of each conduit entering sheet metal cabinet or box in dry or damp locations.
  - a. Plastic bushing may be used on 3/4 inch conduit in lieu of insulated bushing.

- b. Terminate conduit ends within cabinet/box at the same level.
- B. For Rigid and Intermediate Metal Conduit: Use threaded fittings and accessories. Use 3 piece conduit coupling where neither piece of conduit can be rotated.
- C. For Electrical Metallic Tubing: Use compression type connectors and couplings.
- D. For Flexible Metal Conduit: Use flexible metal conduit connectors.
- E. For Liquid-tight Flexible Metal Conduit: Use liquid-tight connectors.
- F. For Wireways: Use wireway manufacturer's standard fittings and accessories.

END OF SECTION 260532



## SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

#### 1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. NBR: Acrylonitrile-butadiene rubber.
- G. RNC: Rigid nonmetallic conduit.

#### 1.3 MATERIALS

- A. Metal Conduits and Fittings:
  - 1. GRC.
  - 2. ARC.
  - 3. PVC-coated rigid steel conduit].
  - 4. EMT.
  - 5. FMC: Zinc-coated steel.
  - 6. LFMC.
  - 7. Fittings:
    - a. Conduit fittings for hazardous (classified) locations.
    - b. EMT: Steel type. Provide compression coupling up to 1-1/4 inch and setscrew 1-1/2 inch and larger.
    - c. Expansion fittings.
    - d. PVC coated.
- B. Nonmetallic Conduit and Fittings:
  - 1. ENT.
  - 2. RNC.

3. LFNC.
  4. HDPE.
  5. Fittings: Match conduit.
- C. Metal Wireways and Auxiliary Gutters: Sheet metal with [ screw-cover type for indoor and Flanged-and-gasketed type for outdoors unless otherwise indicated.
- D. Nonmetallic Wireways and Auxiliary Gutters: PVC plastic.
- E. Surface Metal Raceways: Metal, galvanized steel, with snap-on covers.
- F. Surface Nonmetallic Raceways: Two- or three-piece, rigid PVC.
- G. Boxes, Enclosures, and Cabinets:
1. Metal Outlet and Device Boxes: Aluminum.
  2. Nonmetallic outlet and device boxes.
  3. Metal Floor Boxes: Cast metal or[Sheet metal, fully adjustable.
  4. Nonmetallic Floor Boxes: Non-adjustable, rectangular.
  5. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb.
  6. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
  7. Small sheet metal pull and junction boxes.
  8. Cast-metal access, pull, and junction boxes.
  9. Box extensions.
  10. Gangable boxes are allowed.
  11. Hinged-Cover Enclosures: Metal or Nonmetallic.
  12. Cabinets: Galvanized steel.
- H. Handholes and Boxes for Exterior Underground Wiring: Polymer concrete with polymer-concrete, Fiberglass with polymer-concrete, Fiberglass with reinforced concrete, Fiberglass with cast-iron, Fiberglass with hot-dip galvanized-steel diamond-plate or Fiberglass with fiberglass frame and cover, prototype tested for compliance with SCTE 77.
1. Configuration: Open bottom.
  2. Weatherproof cover.
  3. Cover Legend: "ELECTRIC."

#### 1.4 RACEWAY APPLICATION

- A. Outdoors:
1. Exposed: RMC or RNC, Type EPC-80-PVC.
  2. Concealed, Aboveground: RMC.
  3. Underground: RNC, Type EPC-40-PVC, Type EPC-80-PVC,.
  4. Connection to Vibrating Equipment: LFMC.
  5. Boxes and Enclosures, Aboveground: Type 3R.
- B. Indoors:
1. Exposed, Not Subject to Physical Damage: EMT
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Exposed and Subject to Severe Damage: RMC.

4. Concealed: EMT.
  5. Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
  6. Damp or Wet Locations: RMC.
  7. Boxes and Enclosures: Type 1, except Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Threaded rigid steel conduit fittings.
  2. PVC Externally Coated, Rigid Steel Conduits: Fittings listed for use with this type of conduit.
  3. EMT: Setscrew or compression fittings.
  4. Flexible Conduit: Fittings listed for use with flexible conduit.

## 1.5 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. Custom enclosures and cabinets.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Source quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1. Comply with NFPA 70.
  2. N. J. Uniform Construction Code
  3. NECA 1

## 1.7 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 METAL CONDUIT AND TUBING

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflec Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. Manhattan/CDT/Cole-Flex.
  - 7. Maverick Tube Corporation.
  - 8. O-Z Gedney; a unit of General Signal.
  - 9. Wheatland Tube Company.
  - 10. Or Approved Equal.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- E. EMT: ANSI C80.3.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.



1. Fittings for EMT: Insulated set screws ½" through 2"; compression type 2 ½" through 4"; pie cast fittings are not permitted.
  2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

## 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers:
1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arnco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.
  8. Electri-Flex Co.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
  13. Or Approved Equal.
- B. RNC: NEMA TC 2, Type EPC-40-PVC unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

## 2.4 SURFACE RACEWAYS

- A. Surface Nonmetallic Raceways: Two or three-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems Division.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
    - d. Or Approved Equal.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
  14. Or Approved Equal.
- B. Galvanized Steel Outlet Boxes: Standard galvanized steel boxes and device covers by Appleton Electric Co., Beck Mfg./Picoma Industries, Cooper/Crouse-Hinds, Raco/Div. of Hubbell, or Steel City/T & B Corp or approved equal.
- C. Galvanized Steel Junction and Pull Boxes: Code gage, galvanized steel screw cover boxes by Delta Metal Products Inc., Hoffman Enclosures Inc., Hubbell Wiegmann, Lee Products Co., or Rittal/Electromate or approved equal.
- D. Threaded Type Boxes:
1. Outlet Boxes:
    - a. For Dry, Damp Locations: Zinc electroplate malleable iron or cast iron alloy boxes by Appleton Electric Co., Cooper/Crouse-Hinds Co., OZ/ Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel covers to suit application or approved equal.
    - b. For Wet Locations: Malleable iron or cast iron alloy boxes with hot dipped galvanized or other specified corrosion resistant finish as produced by Cooper/Crouse-Hinds (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws, and malleable iron covers gasketed to suit application or approved equal.
  2. Adfa. Junction and Pull Boxes:
    - a. For Dry, Damp Locations: Zinc electroplate cast iron boxes by Appleton Electric Co., Cooper/Crouse-Hinds, OZ/Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel or cast iron cover or approved equal.
    - b. For Wet Locations: Cast iron boxes by Cooper/Crouse-Hinds' (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws and cast iron cover gasketed to suit application or approved equal.
  3. Conduit Bodies, Threaded (Provided with a Volume Marking):
    - a. For Dry, Damp Location: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies or approved equal.
    - b. For Wet Locations: Malleable iron or cast iron alloy bodies with hot dipped galvanized or other specified corrosion resistant finish; Cooper/Crouse-Hinds' Condulets (hot dipped galvanized or Corro-free epoxy power coat), OZ/Gedney Co.'s Conduit Bodies (hot dipped galvanized), or Thomas & Betts Corp.'s Conduit Bodies (hot dipped galvanized)

with stainless steel cover screws and malleable iron covers gasketed to suit application or approved equal.

- E. Specific Purpose Outlet Boxes: As fabricated by equipment manufacturers for mounting their equipment thereon.
- F. Outlet Boxes and Related Products for Fire Rated Construction:
  - 1. Parameters For Use of Listed Metallic Outlet or Switch Boxes: UL Electrical Construction Equipment Directory - Metallic Outlet Boxes (QCIT).
  - 2. Wall Opening Protective Materials: As listed in UL Fire Resistance Directory - Wall Opening Protective Materials (CLIV), or UL Electrical Construction Equipment Directory - Wall Opening Protective Materials (QCSN).
- F. Floor Power/Data Boxes (FB):
  - 1. Three gang configuration, stamped steel floor box. Box shall be 3 by 4 by 11 inches nominal and have recessed power activations and data and audio/video compartments. Knockouts shall be available in 1/2", 3/4", and 1 inch sizes.
  - 2. Provide three gang polycarbonate concrete floor flange, color as selected by Architect.
  - 3. Model Wiremold Evolution series or approved equal.
- G. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- H. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- I. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- J. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- K. Nonmetallic Floor Boxes: Nonadjustable, round.
- L. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- M. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.
- N. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
- O. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

1. Manholes for service conduits or duct banks shall be constructed and placed in accordance with the requirements of the affected utility company. All handholes for utility service shall comply with all requirements, including Manufacturer, of the affected utility company.
- B. Description: Comply with SCTE 77.
1. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
  2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  4. Cover Legend: Molded lettering, as indicated for each service.
  5. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers:
    - a. AC Miller Concrete Products
    - b. Armorcast Products Company
    - c. Carson Industries LLC.
    - d. CDR Systems Corporation.
    - e. NewBasis.
    - f. Rotondo Precast.
    - g. Quazite.
    - h. Or Approved Equal.
- D. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    - e. Or Approved Equal.
- E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
1. Manufacturers:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.
    - d. Or Approved Equal.

## 2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.8 SLEEVE SEALS

- A. Manufacturers:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Or Approved Equal.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.9 SUPPORTING DEVICES

- A. Fasteners: Furnish all fasteners and hardware compatible with the materials and methods required for attachment of supporting devices.
  - 1. Slotted Type Concrete Inserts: Galvanized pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive steel nut and with knockout cover, hot-dipped galvanized in compliance with ASTM A 123.
  - 2. Masonry Anchorage Devices: Expansion shields complying with FS FF-S-325, as follows:
    - a. Furnish lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single unit class, Group I, Type I, Class 1.
    - b. Furnish lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded nut type, multiple unit class, Group I, Type 1, Class 2.
    - c. Furnish bolt anchor expansion shields for lag bolts, zinc alloy, long-shield anchors class, Group II, Type 1, Class 1.
    - d. Furnish bolt anchor expansion shields for bolts, closed-end bottom bearing class, Group II, Type 2, Class 1.

3. Toggle Bolts: Tumble-wing type, complying with FS FF-B-588C, Type, class and style as required.
4. Nuts, Bolts, Screws, Washers:
  - a. General: Furnish zinc-coated fasteners, with galvanizing complying with ASTM A 153 for exterior use or where built into exterior walls. Furnish fasteners for the type, grade and class required for the particular installation.
  - b. Standard Nuts and Bolts: Regular hexagon head type, complying with ASTM A 307, Grade A.
  - c. Lag Bolts: Square head type, complying with FS FF-B-561C.
  - d. Machine Screws: Cadmium plated steel, complying with FS FF-S-92.
  - e. Wood Screws: Flat head carbon steel, complying with FS FF-S-111.
  - f. Plain Washers: Round, general assembly grade carbon steel, complying with FS FF-W-92.
  - g. Lock Washers: Helical spring type carbon steel, complying with FS FF-W-84.
- B. "C" Beam Clamps:
  1. For 1 inch Conduit Maximum: B-Line Systems Inc.'s BG-8-C2, BP-8-C1 Series, or Caddy Fastener Div./Erico Products Inc.'s BC-8P and BC-8PSM Series or approved equal.
  2. For 3 inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50WB Series hangers, Kindorf/T&B Corp.'s 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWBS Series hanger or approved equal.
  3. For 4 inch Conduit Maximum: Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger or approved equal.
  4. For Threaded Rods (100 lbs. load max.): Caddy Fastener Div./Erico Products Inc.'s BC-4A or approved equal.
  5. For Threaded Rods (200 lbs. load max.): Appleton Electric Co.'s BH-500 Series, Kindorf/T&B Corp.'s 500 Series, or OZ/Gedney Co.'s IS-500 Series or approved equal.
  6. For Threaded Rods (300 lbs. load max.): Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip or approved equal.
- C. Fastener Fittings for Wood and Existing Masonry: Kindorf/T&B Corp.'s E-243, E-244, E-245, E-170, or Versabar Corp.'s VX-4310, VX-2308, VX-4308, VX-4309 or approved equal.
- D. Pipe Straps: Two hole steel conduit straps; Kindorf/T&B Corp.'s C-144 or C-280 Series or approved equal.
- E. Pipe Clamps: One-hole malleable iron type clamps; Kindorf/T&B Corp.'s HS-400 Series, or OZ/Gedney Co.'s 14-50 Series or approved equal.
- F. Channel Support System and Accessories: 12 gage galvanized steel channel and accessories; B-Line System Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches), Kindorf/T&B Corp.'s B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches), Unistrut Corp.'s, P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5500 (1-5/8 x 3-1/4 inches), or Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches) or approved equal.

- G. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erco Products Inc. or approved equal.

## 2.10 NAMEPLATES AND TAGS

- A. General: Precision engraved letters and numbers with uniform margins, character size minimum 3/16 inch high.
1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit or IMC.
  2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC or EMT.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.
  5. Non-Metallic Conduit
    - a. Schedule 40 – Where raceways are in slab in below grade levels, for raceway duct banks.
    - b. Schedule 80 – For underground raceways outside of building which are not encased in concrete.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:
  3.
    - a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - b. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: Rigid steel conduit or IMC.
  7. Corrosive areas: PVC coated RMC.
  8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
  9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway or EMT.

10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway or EMT.
  11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Install a maximum of 150 feet between pull points, and reduce this by 25 feet for each 90 degree bend. Underground conduits for site lighting may be run a maximum of 200 feet between pole lights without an additional pull point. Underground service conduits shall meet the requirements of the utility company.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install exposed at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Surface mounted installations in occupied areas, where allowed on the drawings, shall be equipped with skirts to cover conduits above and below the panels or boxes. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in junction box, which after completion, is accessible to facilitate future branch circuit extension.
- H. Locate raceways so that strength of structural members is unaffected and they do not conflict with services of other trades. Install 1-inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in manner accepted by Engineer. Draw up couplings and fittings full and tight. Protect exposed threads from corrosion by coating with red lead or zinc chromate after installation.
- I. Raceways Embedded in Slabs:



1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Securely tie embedded raceway in place prior to embedment.
  3. Raceways installed below or in floor slabs must extend minimum of 6 inches above finished slab to first connector, unless otherwise noted.
  4. Lay out work in advance to avoid excessive concentrations of raceway runs.
  5. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  6. Change from RNC, Type EPC-40-PVC to rigid steel conduit, or IMC before rising above the floor.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- L. Tighten set screws of threadless fittings with appropriately sized screwdriver or nut driver as suits the screw design.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- N. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
  4. All communications conduits and sleeves shall be terminated with non-metallic bushings.
- O. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- P. Refer to Division 27 Section "COMMUNICATIONS AND DATA SYSTEMS RACEWAYS" for additional requirements.
- Q. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- R. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures. For equipment subject to vibration, noise transmission, or movement; and for all motors use a maximum of 36 inches of flexible conduit. Use LFMC in damp or wet locations. Install separate ground conductor across or through all flexible connections. Comply with NFPA 70 if more restrictive.

- S. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Install a second isolated ground conductor to receptacles or other devices requiring an isolated ground.
- T. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from outside to inside above ground. Explosion proof type seals are not required for this application.
  - 2. Where otherwise required by NFPA 70.
- U. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
  - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Conduits routed on rooftops within 6 inches of the roof surface shall be designed for an additional 30 degrees F temperature rise.
    - d. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
    - e. Attics: 135 deg F temperature change.
  - 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- V. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

### 3.3 BOXES

- A. Recessed Boxes in Masonry Walls: Saw-cut opening for box in masonry block horizontally in center of cell and vertically with the top flush with the top of the block, and install box flush with surface of wall. Saw cuts shall not extend more than 1/8 inch beyond box dimensions. Repair any block surfaces to original condition if saw cuts exceed this dimension. Adjust mounting height of box as required to maintain all boxes in a single course to align with the same edge of the blocks. Electrical Contractor shall be responsible for ensuring all unacceptable block cuts are repaired.
- B. Recessed boxes in drywall Walls: Outlet and device boxes shall be securely and rigidly attached or supported plumb, level, and true.

- C. Outlet and device boxes shall be located so as to not be blocked by furniture, millwork other equipment, or otherwise rendered not accessible or functional. Contractor shall relocate any boxes not meeting these criteria at no cost to the project.
- D. The boxes shall be located so that the cover or device plate will not span different types of building finishes either vertically or horizontally. Mounting heights shall be adjusted to prevent covering different finish materials, but shall remain within the parameters of the New Jersey Barrier Free Subcode.
- E. Boxes for switches near doors shall be located on the side opposite the hinge and close to the door trim.
- F. Covers for outlet boxes shall be of a type designed, intended and appropriate for the use and location, and have suitable corrosion protection. Device plates shall not be used as covers for exposed installations. Plates shall be installed plumb.
- G. Back to back outlets are not allowed in any wall. Boxes located on opposite side of fire rated walls shall be separated horizontally by a minimum of two feet. Where this separation is not feasible or desirable, such as for switches at doorways, provide fire stop pads behind each box to maintain fire wall rating.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- J. Junction and pull boxes shall be used where necessary to facilitate the pulling of wire or cable.
- K. Consideration shall be given to the size and number of conductors, number of bends in the raceway, and the need for support of conductors in vertical raceways.
- L. Junction and pull boxes shall be of a type intended or suitable for the use and location.

### 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.

- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### 3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.8 OUTLET, JUNCTION AND PULLBOX INSTALLATION

- A. Mounting Position of Wall Outlets For Wiring Devices: Unless otherwise indicated, install boxes so that the long axis of each wiring device will be vertical.
- B. Height of Wall Outlets: Unless otherwise indicated, locate outlet boxes with their center lines at the following elevations above finished floor:

	MOUNTING HEIGHT
Lighting Fixtures	6'-0"
Exit Lights	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of exit light. Otherwise mount exit light so that it's top is 6 inches below finished ceiling. Adjust height and clearances as required to suit installation over doors.
Switches	4'-0"
Single & Duplex Receptacles	1'-6"*
Water Cooler Receptacles	2'-0"
IP Digital Clock Data Receptacles	7'-6"
Special Purpose Receptacles	4'-0"
Manual Fire Alarm Boxes	4'-0"
Audible Notification Appliances	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of appliance. Otherwise mount appliance so that it's top is 6 inches below finished ceiling.
Visible Notification Appliances	Install outlet so that the bottom of the visible lens will be 6'-8" AFF.
Combination Audible/Visible Notification Appliances	Install outlet so that the bottom of the visual lens will be 6'-8" AFF, and the audible section will be above the visible section.
Telecommunications	2'-0"
Data	1'-6"
Data Marked H.	Install outlet so that the highest operable part of the wall mounted telephone will not be more than 4'-0" AFF.

\*In areas containing heating convectors, install outlets above convectors at height indicated on drawings.

- C. Supplementary Junction and Pull Boxes: In addition to junction and pull boxes indicated on the drawings and required by NFPA 70, provide supplementary junction and pull boxes as follows:
1. When required to facilitate installation of wiring.
  2. At every third 90 degree turn in conjunction with raceway sizes over 1 inch.
  3. At intervals not exceeding 100 feet in conjunction with raceway sizes over 1 inch.
- D. Box Schedule for Concealed Conduit System:
1. Non-Fire Rated Construction:
    - a. Depth: To suit job conditions and comply with NFPA 70 Article 370.
    - b. For Lighting Fixtures: Use galvanized steel outlet boxes designed for the purpose.
      - 1) For Fixtures Weighing 50 lbs. or Less: Box marked "FOR FIXTURE SUPPORT".

- 2) For Fixtures More Than 50 lbs: Box listed and marked with the weight of the fixture to be supported (or support fixture independent of the box).
- c. For Ceiling Suspended Fans:
  - 1) For Fans Weighing 35 lbs or Less: Marked "Acceptable for Fan Support."
  - 2) For Fans Weighing More Than 35 lbs, up to 70 lbs: Marked "Acceptable for Fan Support up to 70 lbs (or support fan independent of the box)."
- d. For Junction and Pull Boxes: Use galvanized steel boxes with flush covers.
- e. For Switches, Receptacles, Etc:
  - 1) Plaster or Cast-In-Place Concrete Walls: Use 4 inch or 4-11/16 inch galvanized steel boxes with device covers.
  - 2) Walls Other Than Plaster or Cast-In-Place Concrete: Use type of galvanized steel box which will allow wall plate to cover the opening made for the installation of the box.
2. Recessed Boxes in Fire Rated (2 hour maximum) Bearing and Nonbearing Wood or Steel Stud Walls (Gypsum Wallboard Facings):
  - a. Use listed single and double gang metallic outlet and switch boxes. The surface area of individual outlet or switch boxes shall not exceed 16 square inches.
  - b. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet of wall surface.
  - c. Securely fasten boxes to the studs. Verify that the opening in the wallboard facing is cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.
  - d. Separate boxes located on opposite sides of walls or partitions by a minimum horizontal distance of 24 inches. This minimum separation distance may be reduced when wall opening protective materials are installed according to the requirements of their classification.
  - e. Use wall opening protective material in conjunction with boxes installed on opposite sides of walls or partitions of staggered stud construction in accordance with the classification requirements for the protective material.
3. Other Fire Rated Construction: Use materials and methods to comply with the listing requirements for the classified construction.

E. Box Schedule for Exposed Conduit System:

1. Dry and Damp Locations: Use zinc electroplate or hot dipped galvanized threaded type malleable iron or cast iron alloy outlet, junction, and pullboxes or conduit bodies provided with a volume marking in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.
  - a. Galvanized steel boxes may be used in conjunction with conduit sizes over 1 inch in non-hazardous dry and damp locations.
  - b. Galvanized steel boxes may be used in conjunction with electrical metallic tubing where it is allowed (specified) to be installed exposed as branch circuit conduits at elevations over 10'-0" above finished floor.
2. Wet Locations: Use threaded type malleable iron or cast iron alloy outlet junction, and pullboxes or conduit bodies (provided with a volume marking) with hot dipped galvanized or other specified corrosion resistant coating in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.
  - a. Use corrosion resistant boxes in conjunction with plastic coated rigid ferrous metal conduit.

3. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Equipment Used With Exposed Raceway):
  - a. Use finishing collar where surface mounted equipment is installed on an exposed raceway outlet box and the equipment base is larger than the outlet box.
  - b. Use combination finishing collar/outlet box where surface mounted equipment is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into equipment body due to equipment design.
- F. Specific Purpose Outlet Boxes: Use to mount equipment when available and suitable for job conditions. Unless otherwise specified, use threaded type boxes with finish as specified for exposed conduit system, steel (painted) for surface metal raceway system and galvanized steel for recessed installations.

### 3.9 SUPPORTING DEVICE INSTALLATION

- A. Attachment of Conduit System:
  1. Wood Construction: Attach conduit to wood construction by means of pipe straps with wood screws or lag bolts.
  2. Masonry Construction: Attach conduit to masonry construction by means of pipe straps and masonry anchorage devices.
  3. Steel Beams: Attach conduit to steel beams by means of "C" beam clamps and hangers.
  4. Multiple Parallel Conduit Runs: Use channel support system.
  5. Conduit Above Suspended Ceiling: Do not rest conduit directly on runner bars, T-bars, etc. Support conduit from ceiling supports or from construction above suspended ceiling.
- B. Metal Stud Construction: Attach raceways and boxes to metal studs by means of supporting fasteners manufactured specifically for the purpose.
  1. Support and attach outlet boxes so that they cannot torque/twist. Either:
    - a. Use bar hanger assembly, or;
    - b. In addition to attachment to the stud, also provide far side box support.
- C. Support of Lighting Fixtures:
  1. General: Support fixtures with suitable accessories.
  2. Number of Supports (LED Fixtures):
    - a. Support individual LED fixtures less than 2 feet wide at 2 points. Support continuous row fluorescent fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of suspension over the row of fixtures.
    - b. Support individual LED fixtures 2 feet or wider at 4 corners. Support continuous row fluorescent fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of suspension over the row of fixtures.

END OF SECTION 260533





## SECTION 260534 – ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes identification of electrical materials, equipment, and installations.

#### 1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Schedule of identification nomenclature to be used for identification signs and labels.
- D. Samples for each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

#### 1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with ANSI C2.

#### 1.05 SEQUENCING AND SCHEDULING

- A. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- B. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Brady USA, Inc.; Industrial Products Div.
  - 2. Ideal Industries, Inc.
  - 3. Panduit Corp.
  - 4. Or approved equal

## 2.02 RACEWAY AND CABLE LABELS

- B. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- C. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
  - 1. Color: Black legend on orange field.
  - 2. Legend: Indicates voltage.
  - 3. Legend: Indicates voltage and service.
- D. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
- E. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- F. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).
- G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- H. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- I. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
- J. Aluminum-Faced Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, and punched for the fastener. Preprinted legends suit each application.
- K. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2 inches (51 by 51 mm) by 0.05 inch (1.3 mm).

## 2.03 ENGRAVED NAMEPLATES AND SIGNS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Engraving stock, melamine plastic laminate, 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes.
  - 1. Engraved Legend: Black letters on white face.
  - 2. Punched for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch (1-mm), galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6.4-mm) grommets in corners for mounting.
- E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

## 2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength: 50 lb (22.3 kg) minimum.
  - 3. Temperature Range: Minus 40 to 185 deg F (Minus 4 to 85 deg C).
  - 4. Color: As indicated where used for color coding.
- B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- F. Install painted identification as follows:
  - 1. Clean surfaces of dust, loose material, and oily films before painting.
  - 2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
  - 3. Apply one intermediate and one finish coat of silicone alkyd enamel.
  - 4. Apply primer and finish materials according to manufacturer's instructions.
- G. Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of the systems listed below for identification.
  - 1. Bands: Pretensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.

2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25 feet (7.6 m) in congested areas.
  3. Colors: As follows:
    - a. Fire-Alarm System: Red.
    - b. Security System: Green.
    - c. Wireless Access Yellow
    - d. Data System Network: Blue.
    - e. Telephone: Blue.
- H. Install Circuit Identification Labels on Boxes: Label externally as follows:
1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
  2. Concealed Boxes: Plasticized card-stock tags.
  3. Labeling Legend: Permanent, waterproof listing of panel circuit number or equivalent.
- I. Color Coding for 120/208 Volt Electric Light and Power Wiring:
1. Color Code:
    - a. 2 wire circuit - black, white.
    - b. 3 wire circuit - black, red, white.
    - c. 4 wire circuit - black, red, blue, white.
  2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.
    - a. "White" for Sizes No. 6 AWG or Smaller:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length.
    - b. "White" for Sizes Larger Than No. 6 AWG:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length, or:
      - 3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
  3. Colors (Black, Red, Blue):
    - a. For Branch Circuits: Continuous color outer finish.
    - b. For Feeders:
      - 1) Continuous color outer finish, or:
      - 2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutter, pullboxes, and manholes.

- J. Color Coding For 277/480 Volt Electric Light and Power Wiring:
1. Color Code:
    - a. 2 wire circuit – brown, gray.
    - b. 3 wire circuit – brown, yellow, gray.
    - c. 4 wire circuit – brown, yellow, orange, gray.
  2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase to phase circuits.
    - a. “Gray” For Sizes No. 6 AWG or Smaller.
      - 1) Continuous gray outer finish.
    - b. “Gray” For Sizes Larger Than No. 6 AWG:
      - 1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color coding tape at terminations, and at 1’ 0” intervals in gutters, pullboxes, and manholes.
    - c. Colors (Brown, Yellow, Orange):
    - d. For Branch Circuits: Continuous color outer finish.
    - e. For Feeders:
      - 1) Continuous color outer finish, or:
      - 2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1’ 0” intervals in gutters, pullboxes, and manholes.
- K. More Than One Nominal Voltage System Within A building: Permanently post the color coding scheme at each branch-circuit panelboard.
- L. Existing Color Coding Scheme: Where an existing color coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.
- M. Color Code For Wiring Other Than Electric Light and Power: In accordance with ICEA standard S-73-532 (NEMA WC57-2004). Other coding methods may be used, as approved.
- N. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, electric rooms.
1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
  2. Fasten tags with nylon cable ties; fasten bands using integral ears.
- O. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
  3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.

P. Apply identification to Plywood Backboards as follows:

1. Apply stencil indicating use of backboard ("Fire," "Video," "Public Address," "Telephone") in colors as specified under G.3.

Q. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

R. Install identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use lettering 2 inches (51 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment.
  - a. Panelboards, electrical cabinets, and enclosures.
  - b. Access doors and panels for concealed electrical items.
  - c. Motor starters.
  - d. Junction Box – Label covers with circuit number(s) within.
  - e. Push-button stations.
  - f. Contactors.
  - g. Remote-controlled switches.
  - h. Time Clocks.
  - i. Dimmers.
  - j. Control devices.
  - k. Clock/program master equipment.
  - l. Call system master station.
  - m. Fire-alarm master station or control panel.
  - n. Fire Alarm relay/boxes.
  - o. Fire Alarm device address per device.
2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION 260534

## SECTION 260536 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Ladder cable trays.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

##### B. Shop Drawings: For each type of cable tray.

##### C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

##### B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

##### A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 to design cable tray supports and seismic bracing.

##### B. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. Component Importance Factor: 1.5.

#### 2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

##### A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles on individual cable tray types for specific values for uniform load distribution, concentrated load, and load and safety factor parameters.

## 2.3 LADDER CABLE TRAYS

### A. Description:

1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
2. Rung Spacing: 12 inches o.c.
3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
5. No portion of the rungs shall protrude below the bottom plane of side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
7. Minimum Usable Load Depth: 4 inches.
8. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
9. Width: 12 inches unless otherwise indicated on Drawings.
10. Fitting Minimum Radius: 24 inches.
11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.
13. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

## 2.4 MATERIALS AND FINISHES

### A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Mill galvanized before fabrication.
  - a. Hardware: Galvanized, ASTM B 633, Chromium-zinc plated, ASTM F 1136.
5. Finish: Electrogalvanized before fabrication.
6. Finish: Hot-dip galvanized after fabrication.
  - a. Hardware: Chromium-zinc plated, ASTM F 1136, [Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
7. Finish: Epoxy-resin, Powder-coat enamel paint.
  - a. Hardware: Chromium-zinc plated. ASTM F 1136, Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
8. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
9. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.



## 2.5 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.6 WARNING SIGNS

- A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Division 26.

## 2.7 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA FG 1.

# PART 3 - EXECUTION

## 3.1 CABLE TRAY INSTALLATION

- A. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- B. Fasten cable tray supports to building structure and install seismic restraints.
- C. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lbs. Comply with requirements in Division 26. Comply with seismic-restraint details according to Division 26.
- D. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- E. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- F. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA FG 1 Space connectors and set gaps according to applicable standard.
- G. Seal penetrations through fire and smoke barriers. Comply with requirements in Division 7.
- H. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

- I. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- J. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- K. Install warning signs in visible locations on or near cable trays after cable tray installation.

### 3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Division 26.
- B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."
- D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

### 3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket.
- C. Fasten cables on vertical runs to cable trays every 18 inches.
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.
- E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

### 3.4 CONNECTIONS

- A. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.
7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

### 3.6 PROTECTION

A. Protect installed cable trays and cables.

END OF SECTION 260536



## SECTION 260543 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For ducts and conduits, duct-bank materials, manholes, handholes, and boxes, and their accessories.

##### B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:
  - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
  - b. Include duct entry provisions, including locations and duct sizes.
  - c. Include reinforcement and joint details, frame and cover design, and manhole frame support rings.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
  - a. Include dimensioned plans, sections, elevations, accessory locations, and fabrication and installation details.
  - b. Include duct entry provisions, including locations and duct sizes.

#### 1.3 DEFINITION

##### A. RNC: Rigid nonmetallic conduit.

#### 1.4 INFORMATIONAL SUBMITTALS

##### A. Duct-Bank Coordination Drawings: Show duct profiles, locations of expansion fittings, and coordination with other utilities and underground structures on Drawings signed and sealed by a qualified professional engineer.

##### B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

##### C. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.

4. Grounding details.
  5. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  6. Joint details.
- D. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
  2. Cover design.
  3. Grounding details.
  4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- E. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- F. Source quality-control reports.
- G. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

#### 1.7 PROJECT CONDITIONS

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

## 1.8 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the Authority or others unless permitted by the Authority, and then only after arranging to provide temporary electrical service.
- B. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Rigid Ferrous Metal Conduit: Steel, galvanized on the outside and inside (conduit enameled on the inside will not be accepted), UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit-Steel or Rigid Steel Conduit), as manufactured by Allied Tube & Conduit Corp., LTV Steel Tubular Products Co., Triangle Wire & Cable Inc., or Wheatland Tube Co. or approved equal.
- B. Rigid Nonmetallic Conduit And Fittings (Concrete Encased): Cantex, Inc.'s Schedule 40, Carlon Electrical Products Inc.'s Plus 40, CertainTeed Corp.'s Schedule 40, Omni/Opti-Com Manufacturing Network, Inc.'s Schedule 40 or Queen City Plastic Inc.'s Schedule 40 or approved equal.
- C. Conduit Spacers and Levelers: Commercially manufactured type to suit conduit, installation and spacing requirements.
- D. Duct Seal: Appleton Electric Co.'s DUC Weatherproof Compound, Manville Corp.'s Duxseal, OZ/Gedney Co.'s DUX, or Thomas & Betts Corp.'s DX or approved equal.
- E. Drag Line: Minimum 1/8 inch polypropylene monofilament utility rope; American Synthetic Ropes' Flotorope, Greenlee Tool Co.'s 2 ply Rope 431, or Thomas Industries/Jet Line Products' Rope 232 or approved equal.
- F. Thru Wall Sealing Bushings:
  - 1. For Walls Which Have or Will Have Membrane Waterproofing:
    - a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK thruwall seal and Type FSKA membrane clamp adapter or approved equal.
    - b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM and Type CSMC with membrane clamp adapter or approved equal.
  - 2. For Walls Which Will Not Have Membrane Waterproofing:
    - a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK or approved equal.
    - b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM, or Thunderline Corp.'s Link-Seal or approved equal.
- G. End Bells:
  - 1. For Rigid Ferrous Metal Conduit: OZ/Gedney Co.'s Type TNS or approved equal.
  - 2. For Rigid Nonmetallic Conduit: Conduit manufacturer's standard end bells or approved equal.

- H. Insulated Grounding Bushings: Appleton Electric Co.'s GIB-50 Series, Crouse Hinds GLL Series, OZ/Gedney Co.'s IBC-50L Series, Raco Inc.'s 1212 Series, or Thomas & Betts Corp.'s 3870 or BG Series or approved equal.

## 2.2 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

## 2.3 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.4 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and] Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

## 2.5 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.
- B. Duct Accessories:
  - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers.
  - 2. Warning Tape: Underground-line warning tape specified in Division 26.
  - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi red concrete and labeled "ELECTRIC."

## 2.6 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Acceptable Manufacturers:
  - 1. Carder Concrete Products.
  - 2. Christy Concrete Products.
  - 3. Elmhurst-Chicago Stone Co.
  - 4. Oldcastle Precast Group.
  - 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
  - 6. Utility Concrete Products, LLC.
  - 7. Utility Vault Co.
  - 8. Wausau Tile, Inc.



9. Or approved equal.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and open bottom unless closed-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
  2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  3. Cover Legend: Molded lettering, "ELECTRIC." Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
  4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    - a. Extension shall provide increased depth of 12 inches
    - b. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.
  5. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
  6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
  7. Windows: Precast, reinforced openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches \ vertically and horizontally to accommodate alignment variations.
    - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
1. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    - a. Type and size shall match fittings to duct or conduit to be terminated.
    - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
  2. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.7 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application".
1. Color: Gray
  2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC" Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
  6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
  7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.
    - e. Quazite.
    - f. Or Approved Equal.
- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    - e. Or Approved Equal.
- D. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be plastic.
1. Manufacturers:
    - a. Carson Industries LLC.
    - b. Nordic Fiberglass, Inc.
    - c. PenCell Plastics.
    - d. Or Approved Equal.
- E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of hot-dip galvanized-steel diamond plate.
1. Acceptable Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.

- d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- e. Or Approved Equal.

## 2.8 PRECAST MANHOLES

- A. Comply with ASTM C 858.
- B. Structural Design Loading: Comply with requirements in "Underground Enclosure Application".
- C. Windows: Precast reinforced openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
- D. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
- E. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

## PART 3 - EXECUTION

### 3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables More than 600 V: RNC, NEMA [Type EPC-80] [Type EPC-40]-PVC, in concrete-encased duct bank unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80, Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- D. Underground Ducts Crossing Paved Paths, Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

### 3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-10 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8] structural load rating.

4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.
5. Cover design load shall not exceed the design load of the handhole or box.

### 3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31, but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" in Division 1.

### 3.4 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 both horizontally and vertically, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
  3. Grout end bells into structure walls from both sides to provide watertight entrances.

- G. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  2. Grout end bells into structure walls from both sides to provide watertight entrances.
- H. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26.
- I. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- J. Pulling Cord: Install 100-lbf-test nylon cord in empty ducts.
- K. Concrete-Encased Ducts: Support ducts on duct separators.
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 for pipes less than 6 inches in nominal diameter.
  2. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  3. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
  4. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
  6. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
  7. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  9. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
  10. Pouring Concrete: Comply with requirements in "Concrete Placement" in Division 3. Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

L. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 22 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Division 22 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 22 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

M. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

N. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Comply with requirements in Division 3 for cast-in-place concrete, formwork, and reinforcement.

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Install handholes with bottom below frost line, below grade.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in waterproofing Section. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 7. After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

H. Coordinate "Hardware" Paragraph below with Drawings. Delete second option if nonmetallic cable racks are specified. Show locations and quantities of required hardware on Drawings.

I. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

J. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

K. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
  - B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
  - C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  - D. Install handholes and boxes with bottom below frost line, below grade.
  - E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.7 INSTALLATION OF MANHOLES

- A. Spacing:
  - 1. Arrangement for Power and Signal Service: Separate power system conduits from signal system conduits with minimum 6 inches thick concrete wall or 12 inches of earth.
  - 2. Conduit Bank: Separate individual conduits a minimum of 3 inches. Use spacers and levelers located no more than 8 feet apart.
- B. Depth:
  - 1. Existing Grade To Remain: Unless otherwise indicated or directed, install conduit more than 18 inches below existing finished grade.
  - 2. Existing Grade To Be Altered: Unless otherwise indicated or directed, install conduit more than 18 inches below the existing grade where the finished grade is to be higher than the existing grade. Where the finished grade is to be lower than the existing grade, install conduit more than 18 inches below finished grade.
  - 3. Under Roads and Parking Lots:
    - a. Rigid Ferrous Metal Conduit: Unless otherwise indicated or directed, install rigid ferrous metal conduit more than 24 inches below top surface of roads and parking lots.
    - b. Rigid Nonmetallic Conduit (Concrete Encased): Unless otherwise indicated or directed, install concrete encased rigid nonmetallic conduit more than 30 inches below top surface of roads and parking lots.
  - 4. Crossing Obstructions: Use rigid ferrous metal conduit where top of conduit system is less than 18 inches below finished grade when crossing obstructions (heating tunnels, etc.).
  - 5. In Rock:



- a. Unless otherwise indicated on the drawings install rigid ferrous metal conduit or concrete encased rigid nonmetallic conduit at depths previously specified. Backfill with suitable material.
  - b. Where conduit is indicated to be installed at lesser depths, use rigid ferrous metal conduit. Cover conduit with minimum 2 inches of concrete. In exposed rock area fill trench with concrete to surface level of rock.
- C. Pitch:
  1. Pitch conduit away from buildings.
  2. Pitch conduit toward manhole a minimum of 12 inches per 100 feet. On runs where it is impossible to maintain the grade all one way, grade from center so that conduits pitch both directions down toward manholes.
- D. Concrete Encasement for Rigid Non-Metallic Conduit Using Either of the Two Methods Indicated Below: (Concrete Encasement for Rigid Ferrous Metal Conduit is not Required):
  1. Single Pour Method - as detailed on the drawings.
  2. Two Pour Method:
    - a. Lay rigid nonmetallic conduits on a continuous concrete footing not less than 3 inches thick and as wide as the encasement. Install footings straight and true both in line of run and transversely, and finished with an even surface. Incorporate anchoring devices into the footing for use in tying down the conduits. Grade footings so that conduits maintain required pitch. Before installing spacers, levelers, and conduits, let concrete footings harden as required to prevent damage to the footings.
      - 1) Where conduits enter building or manhole wall, reinforce footings for 10 feet with No. 4 rods, 4 inches on center.
      - 2) Footings are not required for rigid ferrous metal conduit.
    - b. After rigid nonmetallic conduits have been laid on footing with spacers and levelers (located no more than 8 feet apart), tie conduits down to the footing, then surround the conduits by concrete not less than 2 inches thick on top and 2 inches on each side. Separate individual conduits a minimum of 3 inches so that each conduit is completely enveloped in concrete.
      - 1) Where conduits enter building or manhole walls, reinforce encasement for 10 feet with No. 4 rods, 4 inches on center.
      - 2) Encasement is not required for rigid ferrous metal conduit.
    - c. Form sides of the concrete encasement. Exception: Earth cuts will be permitted as the form where trenches are neatly excavated in stable soils.
- E. Conduits in Filled Ground: Where indicated reinforce the footing and encasement for rigid nonmetallic conduits 10 feet beyond limits of fill. Reinforcement, footing or encasement is not required for rigid ferrous metal conduit.
- F. Conduits Entering Buildings and Manholes:
  1. Seal conduit entrances into manholes watertight.
  2. Seal conduit entrances into building walls watertight. Exception: Seal is not required in below grade foundation walls associated with slab on grade construction.
  3. Install end bells at conduit entrances into manholes.
  4. Install end bells at conduit entrances into buildings. Exceptions:
    - a. Install insulated grounding bushing on conduit entrance stub up associated with slab on grade construction.

- b. Install insulated grounding bushing and 2 locknuts on conduit where conduit is terminated in cabinet, junction or pull box.
- 5. Provide transition from rigid nonmetallic conduit routed underground or below building slab to rigid ferrous metal conduit within 12 inches of building entry.

G. Cleaning Conduits: Take precautions to prevent foreign matter from entering conduits during installation. After installation clean conduits with tools designed for the purpose.

H. Conduit for Future Use (Spare Conduit and Empty Conduit): Demonstrate to the Director's Representative that conduits installed for future use are clear of obstructions (draw mandrel 1/2 inch less in diameter than conduit). Install a drag line in each conduit.

I. Sealing Ends of Conduits:

- 1. Occupied Conduits: Seal ends of conduits to be used for Work of this contract until cables are to be installed. After cable installation, seal conduits at building entrances and first manhole outside building. Seal with duct seal.
- 2. Conduits For Future Use: Seal the ends of spare and empty conduits at building entrances and manholes. Seal with plastic plugs or a contrasting color cement/sand mixture.

### 3.03 CONDUIT SCHEDULE - TYPES AND USE

A. Rigid Ferrous Metal Conduit: Install in all locations unless otherwise specified or indicated on the drawings.

B. Rigid Nonmetallic Conduit (Concrete Encased): May be installed in all locations except:

- 1. Where conduit stubs up or rises through slab or finished grade.
- 2. Where other type raceways are specified or indicated on the drawings.

### 3.8 GROUNDING

A. Ground underground ducts and utility structures according to Division 26.

### 3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

- 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
- 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
- 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543



## SECTION 260544 – SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

##### A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

##### B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

##### C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches thickness shall be 0.052 inch
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches thickness shall be 0.138 inch

#### 2.2 SLEEVE-SEAL SYSTEMS

##### A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

- a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7.
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
- 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Provide FSK/WSK fittings.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544



## SECTION 260548 – SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
  - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
  - b. Annotate to indicate application of each product submitted and compliance with requirements.

##### B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints.
  - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
3. Seismic -Restraint Details:
  - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events
  - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Welding certificates.

- B. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: C
  - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III
    - a. Component Importance Factor: 1.5
    - b. Component Response Modification Factor: 2.5
    - c. Component Amplification Factor: 1.0
  - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.265
  - 4. Design Spectral Response Acceleration at 1.0-Second Period: .076

#### 2.2 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

#### 2.3 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 603 galvanize-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

## 2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

## 2.5 MECHANICAL ANCHOR BOLTS

- A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.6 ADHESIVE ANCHOR BOLTS

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Indicate on Drawings, by details, schedules, or a combination of both, the locations where hanger rods for individual raceways, bus duct, cable trays, and hanger rods for trapeze hangers require hanger-rod stiffeners.
- C. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

#### A. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch
2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

#### B. Install cables so they do not bend across edges of adjacent equipment or building structure.

#### C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

#### D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

#### E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

#### A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### 3.4 FIELD QUALITY CONTROL

#### A. Perform the following tests and inspections:

1. Obtain Design Consultant's approval before transmitting test loads to structure. Provide temporary load-spreading members.
2. Test at least four of each type and size of installed anchors and fasteners selected by Design Consultant.
3. Test to 90 percent of rated proof load of device.

- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548



## SECTION 260553 – ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

#### 1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

#### 1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

### 2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

### 2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS



- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

## 2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.5 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

## 2.6 UNDERGROUND-LINE WARNING TAPE

- A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

## 2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
3. Insert names and wording of warning signs or labels; e.g., arc-flash, multiple services and voltages, and others.

## 2.8 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
  - 1. Engraved legend with black letters on white face **<Insert colors>**.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

## 2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-adhesive labels not acceptable. Screw labels to enclosures. Engraved, Laminated Acrylic or Melamine Label: with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
  - 1. Exterior Ferrous Metal:
    - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Exterior ferrous-metal primer.
      - 2) Finish Coats: Exterior semigloss alkyd enamel.
  - 2. Exterior Zinc-Coated Metal (except Raceways):
    - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Exterior zinc-coated metal primer.

- 2) Finish Coats: Exterior semigloss alkyd enamel.
3. Interior Ferrous Metal:
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior ferrous-metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
4. Interior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior zinc-coated metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- C. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength: 50 lb, minimum.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black, except where used for color-coding.

## 2.11 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  1. Not less than 6 inches wide by 4 mils thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
  4. Printed legend shall indicate type of underground line.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, and handholes use color-coding conductor tape, marker tape, aluminum wraparound marker labels and write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape and write-on tags. Identify each ungrounded conductor according to source and circuit number.

- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- G. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - 2. Equipment to Be Labeled:

- a. Panelboards, electrical cabinets, and enclosures.
- b. Access doors and panels for concealed electrical items.
- c. Electrical switchboards.
- d. Transformers.
- e. Disconnect switches.
- f. Enclosed circuit breakers.
- g. Motor starters.
- h. Push-button stations.
- i. Contactors.
- j. Remote-controlled switches, dimmer modules, and control devices.
- k. Voice and data cable terminal equipment.
- l. Program equipment.
- m. Television/audio components, racks, and controls.
- n. Fire Alarm Control Panel and Remote Annunciator(s).
- o. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- p. Monitoring and control equipment.
- q. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-adhesive labels not acceptable. Screw labels to enclosures: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- J. Painted Identification: Comply with requirements in Division 9 for surface preparation and paint application.

### 3.3 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot (10-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  1. Emergency Power – Red Labels with White Letters
  2. Power – Black Labels with White Letters
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.

- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including color-code for grounded and ungrounded conductors. Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label

  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power,



lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification. Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label.

1. Labeling Instructions:
  - a. Indoor Equipment: Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
  - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
  - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553



## SECTION 260563 – EQUIPMENT CONNECTIONS AND COORDINATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide final connections to equipment and coordinate same in accordance with the Contract Documents.

#### 1.2 WORK INCLUDED

- A. Equipment to receive final connections shall include but not be limited to the following:

- 1. Lifts.
- 2. Motorized Equipment.
- 3. Appliances.
- 4. Owner Furnished Equipment.
- 5. Refrigeration Machines.
- 6. Kitchen Equipment.

- B. SUBMITTALS

- 1. None required.

- C. QUALITY ASSURANCE

- 1. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following or approved equal:
  - a. American National Standard Safety Code for Elevators Dumbwaiters and Moving Walks (ANSI A17.1).
  - b. Food and Drug Administration.
  - c. NFPA-96.

### PART 2 - PRODUCTS

- 2.1 Only those products listed in Division 26 shall be employed.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION OF DOCUMENTS

- A. Prior to the submitting of bids, this Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment requiring electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment and the coordination thereof.

- B. Connections shall be made in accordance with the manufacturers' recommendations and approved shop drawings.

1. ELEVATORS

- a. Connections for and coordination of elevators shall include but not be limited to the following:
- b. Dedicated power outlets one circuit per car and dedicated circuits for each cab's car lights and fans.
- c. Empty raceway from each controller to nearest telephone backboard for telephone communications.
- d. Fluorescent lighting fixture, switch and duplex outlet within each elevator pit.
- e. Empty raceways from each elevator machine room to Fire Command Center. Size and quantity of raceways as per fire alarm system vendor's requirements.
- f. Empty raceways from elevator machine room to remote elevator status panel. Size and quantity of raceways as per fire alarm system vendor's requirements.
- g. Fused disconnect switches with feeders extended to and connected at each elevator controller. Fuse sizes shall be as per elevator vendor's requirements. All fuses shall be time delay type. Switches shall be installed within sight of motors and controllers.
- h. Firefighter's telephone within elevator cab and appropriate connections at the elevator machine room and Life Safety System.

2. EQUIPMENT

- a. Connections for and coordination of motors and equipment requiring electrical connections shall include but not be limited to the following:
  - 1) Install motor controllers and disconnect switch for each motor and each piece of equipment.
  - 2) Verify that the motor rotation is correct and reconnect if necessary.
  - 3) Ground all equipment; provide separate ground wires in flexible, metal conduit and non-metallic conduit so as to provide an electrically continuous ground path.
  - 4) Provide motor branch circuit conductors and connections to each individual motor controller and from each controller to the motor through an approved disconnect switch. Make final connection in minimum 24 inch length of liquid-tight, flexible, metal conduit.
  - 5) Provide all necessary wiring and connections for interlocking, remote and automatic controls. Installation of equipment and wiring shall be in compliance with shop drawings and manufacturer's recommendations.
  - 6) Where equipment is fed from branch circuit routed in or under the slab, terminate branch circuit at J-box on 2 foot rigid conduit stub-up and make final connection to equipment in liquid-tight, flexible, metal conduit. Provide suitable knee brace on conduit stub-up.
  - 7) Where equipment is fed from overhead, support conduit feeder descending from ceiling on flanged floor fitting with conduit type fitting connecting to motor with 24-inch minimum of liquid-tight flexible steel conduit.
  - 8) Where nameplate on equipment indicates fuse protection the disconnecting means shall be equipped with time delay fuses sized as per manufacturer's recommendations.

3. APPLIANCES

- a. Connections for and coordination of appliances shall include but not be limited to the following:

- 1) The basic requirements for motors and equipment specified above shall apply where applicable.
- 2) Where cord and plugs are provided with the appliances this contractor shall coordinate the receptacle installation to match. Information on the Drawing as to receptacle type is for bidding purposes only.
- 3) Hard wired equipment shall be serviced by disconnecting means as indicated in the National Electrical Code.

#### 4. OWNER FURNISHED EQUIPMENT

- a. The requirements for equipment furnished by the owner for installation by this Contractor shall include but not be limited to the following:
  - 1) The coordination of the proper delivery scheduling of such equipment.
  - 2) The receiving and unloading of such equipment at the property line.
  - 3) The inspection of such equipment for damages, defacement, corrosion, missing components, etc. at the job site. All deficiencies shall be recorded. Deficiencies occurring after inspection shall be corrected by this contractor at his cost.
  - 4) The safe handling at secure storage of such equipment from unloading to the time of permanent installation.
  - 5) The completion of field make up of internal wiring as required.
  - 6) The lamping of equipment.
  - 7) The installation of accessories on such equipment.
  - 8) The installation of such equipment including the transportation of the equipment to the installation area, and the installation of all supports, fasteners, canopies, extensions, etc. required to insure safe support and adaptation to the finished structural, electrical and architectural conditions.
  - 9) The final connections and grounding to the building electrical system including all necessary labor and materials including but not limited to junction box extensions, lug change outs, etc.
  - 10) The testing of such equipment in its final location.

#### 5. REFRIGERATION MACHINES

- a. Connections for and coordination of refrigeration machines shall include but not be limited to the following:
  - 1) The basic requirements for motors and equipment specified above shall apply where applicable.
  - 2) Install motor controller furnished by others and provide six (6) conductors from load side of controller to lugs on machine.
  - 3) Provide 120 volt circuit to oil pump and heater if required, coordinate requirements with approved shop drawings.

#### 6. KITCHEN/LAUNDRY EQUIPMENT CONNECTIONS

- a. This Contractor is to furnish the following electrical equipment/devices and make the following connections, but is not limited to:
  - 1) All junction boxes, electrical outlets, stainless steel cover plates and switches not built into kitchen equipment.
  - 2) All plugs and cords as noted on kitchen/laundry consultant's schedules.
  - 3) Furnish and install shunt-trip branch circuit breakers or shunt-trip main circuit breakers as indicated and disconnect switches for fire control system shut-off

of kitchen equipment below hoods or ventilators as shown on the kitchen consultant's documents or the electrical documents.

- 4) Disconnect switches or other similar devices as required by code.
  - 5) Electro-magnetic overload protection for air compressors/vacuum pumps in the laundry as noted.
  - 6) Provide conduit and wiring, installation of electrical devices furnished by kitchen/laundry equipment trade and interwire between the following:
    - a) Remote refrigeration equipment to evaporative coils.
    - b) Control panels to water-type ventilators and exhaust/supply fans.
    - c) Kitchen exhaust hoods/ventilators to fire control system and shut-offs.
    - d) Signal from fire control system to local fire alarm panel with a dedicated zone per fire control system.
    - e) All outlets and connections shown on electrical kitchen/laundry drawings are indicated for kitchen/laundry equipment only. Refer to electrical drawing(s) which indicates the general areas for outlets and devices for general purpose use.
- A. The electrical kitchen/laundry plans indicate outlet type and location, and connection positions and loads. For final rough-in locations, refer to kitchen/laundry consultant's dimensioned plans. All dimensions shown are from finished floor and finished walls, unless otherwise noted.
- B. Internal electrical work for fabricated food service equipment shall be internally wired and connected by kitchen equipment manufacturer for all kitchen equipment, except as noted.
- C. All electrical work for fabricated food service equipment shall be completely wired by kitchen equipment manufacturer (except as noted above), to a junction box or pull box mounted on the equipment in an accessible position. Final connections between equipment, junction or pull boxes to the electrical panelboard (except as noted) to be the responsibility of this Contractor.
- D. This Contractor shall furnish and install size, type and quantity of beverage dispensing raceways as indicated on the electrical documents. Final connections and bending radii to be verified with kitchen consultant.

END OF SECTION 260563

## SECTION 260800 – ELECTRICAL SYSTEMS COMMISSIONING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

#### 1.2 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Integrated Systems: When referenced this encompasses all control, equipment and systems utilized in support of the facility.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

#### 1.3 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA and as defined in the contract documents.
- B. Attend construction phase commissioning meetings.
- C. Attend test coordination meetings.
- D. Participate in the electrical system maintenance orientation and inspection for assemblies and equipment as directed by the CxA.
- E. Provide information requested by the CxA, including manufacturer cut sheets and shop drawings for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- G. Provide detailed startup procedures.
- H. Provide startup testing for all normal and emergency power equipment and shall coordinate and execute the electrical tasks for the commissioning checklists for all commissioned equipment.
- I. Provide copies of all submittals as required including all changes thereto.
- J. Facilitate the coordination of the commissioning and incorporate commissioning activities (the Commissioning Plan) into the Overall Project Schedule (OPS).
- K. Ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents.

- L. Provide training in the operation and maintenance of installed equipment for the Authority's personnel.
- M. Review and accept construction checklists provided by the commissioning authority.
- N. Complete startup reports and construction checklists as work is completed, and provide to the Commissioning Authority on a weekly basis.
- O. Review and accept commissioning process test procedures provided by the Commissioning Authority.
- P. Complete commissioning process test procedures (functional testing as detailed in functional testing checklists).
- Q. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
- R. Cooperate with the CxA for resolution of issues recorded in the "Issues Log".

#### 1.4 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing and operational sequencing per design documents.
- D. Provide a final written report outlining the commissioning process and including commissioning field documentation

#### 1.5 COMMISSIONING DOCUMENTATION

- A. The contractor shall provide the following information to the CxA for inclusion in the commissioning plan:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
  - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
  - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
  - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
  - 5. System startup reports.
  - 6. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
  - 7. Test and inspection reports and certificates.
  - 8. Corrective action documents.
  - 9. Verification of contractually required static and dynamic testing reports.

#### 1.6 SUBMITTALS

- A. Certificates of readiness.



- B. Certificates of completion of installation, prestart, and startup activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TESTING PREPARATION

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started, and that they are operating in the manner required by the Contract Documents.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing and adjustments have been completed and that testing and adjustment reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required and as directed by the CxA.

### 3.2 TESTING VERIFICATION

- A. Prior to performance of testing, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least (ten) 10 days in advance of testing execution, and provide access for the CxA to witness testing procedures.
- C. Provide technicians, instrumentation, and tools to verify testing of electrical systems at the direction of the CxA.
  - 1. The CxA will notify the electrical contractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
  - 2. The electrical contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
  - 3. Failure of an item includes, emergency power system performance as defined by the authority having jurisdiction and operational sequence as determined in the contract documents including safeties, capacity and operational integrity.
  - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

### 3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning tests at the direction of the CxA.
- B. Scope of electrical system testing can include, but is not limited to, entire electrical power distribution installation from central distribution to branch circuit to individual equipment served. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of interface to the building automation system.
- D. The CxA with coordination of a certified testing agency, shall prepare detailed testing plans, procedures, and checklists for electrical systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Construction Management Representative. After deficiencies are resolved, reschedule tests.
- I. Retesting: The CxA will direct the retesting of the equipment once at no "charge" to the Authority for their time. The CxA's time and expenses incurred for a second retest, if required due to no fault of the CxA, will be reviewed by the Authority to determine the appropriate means of compensation to the CxA for extension of services. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction check listing by the installing contractors, and spot-checked by the CxA during functional testing.

### 3.4 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Electrical Installation and Verification: Testing requirements are specified in Division 26. Provide submittals, test data, inspection records to the CxA.

1. Insulation resistance testing, mechanical integrity tests and inspections, ground testing, continuity, transformer-specific tests, emergency power system and manufacturer startup according to contract, agency and authority having jurisdiction requirements as indicated in Division 26. Electrical contractor shall prepare supporting documentation for compliance for copy to the CxA.
- B. Short Circuit and Coordination Testing, Adjustment and Settings: Field testing and over-current protection coordination as specified in Division 26.
- C. NFPA 110 Chapter 7 Installation Acceptance Testing shall be conducted, including “black start” and load bank testing per Division 26. All testing shall be conducted after manufacturer startup of equipment has been completed for the Emergency Generator, Automatic Transfer Switches and all components and accessories related to the normal and emergency power infrastructure. Time and duration for the load bank test shall be in compliance with the stepped operation for the time and duration as specified in NFPA 110 and not less than two (2) hours to a maximum time as the contract designates for 100% load for the resistive or inductive load bank. Time and durations for the “black start” testing shall be determined to be not less than 1.5 hours (As specified in Div. 26) or until all systems can be verified operational as intended for representative life safety, critical and emergency standby loads. Black start testing shall include, but not be limited to, the following field verification of the following systems:
1. Emergency Generator
  2. Automatic Transfer Switches
  3. Load Banks
  4. Emergency Outlets
  5. BMS Integration (and all associated equipment served)
  6. Emergency Lighting
  7. UPS
  8. Fire alarm
  9. Security
  10. Communication Systems
  11. Branch Circuit Distribution
- D. The following equipment/systems will be commissioned in this project:
1. Emergency Power System, including but not limited to the Generator, Automatic Transfer Switches, Uninterruptable Power Supplies and all control systems.
  2. Fire Alarm System in conjunction with the Authority Having Jurisdiction
  3. Distribution Switchgear
  4. Service Switchgear and Switchboards
  5. Building Grounding System
  6. Motor Control Centers
  7. Transformers and power distribution
  8. Lighting and Lighting Controls
  9. Branch circuit distribution

END OF SECTION 260800



## SECTION 260943 – NETWORK LIGHTING CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components.
  - 1. System Software Interfaces
    - a. Visualization Interface
  - 2. System Backbone and Integration Equipment
    - a. System Controller
  - 3. Wired Networked Devices
    - a. Wall Stations
    - b. Graphic Wall Stations
    - c. Auxiliary Input/Output Devices
    - d. Occupancy and Photocell Sensors
    - e. Wall Switch Sensors
    - f. Embedded Sensors
    - g. Power Packs and Secondary Packs
    - h. Networked Luminaires
    - i. Relay and Dimming Panel
    - j. Bluetooth® Low Energy Programming Device
- B. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. Data Bus: Two wires used to communicate with bus connected devices.
- C. DDC: Direct digital control.
- D. Device: A collective term for connected devices, including drivers, luminaires, switches, relays, and similar.
- E. Group: A set of devices that respond at the same time to messages on the data bus.
- F. IP: Internet protocol.

- G. IR: Infrared.
- H. LAN: Local area network.
- I. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- J. Scene: Digital light level associated with a preset.
- K. TCP/IP: Transmission control protocol/Internet protocol.
- L. VPN: Virtual private network.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Bill of Materials necessary to install the networked lighting control system.
  2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
  3. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  4. Sound data including results of operational tests of central dimming controls.
  5. Operational documentation for software and firmware.
  6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
- B. Shop Drawings:
  1. Floor Plans: Location, orientation, and coverage area of each sensor; group designations; and other specific design symbols and designations as required to define the installation, location, and configuration of all control devices.
  2. Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
  3. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices used. Describe characteristics of network and other data communication lines.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
  1. Show interconnecting signal and control wiring, and interface devices that show compatibility of inputs and outputs.

2. For control interfaces and adapters, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the protocol.
- B. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
- C. Sample Warranty: For manufacturer's special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

#### 1.7 WARRANTY

- A. Manufacturer's Warranty: The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of substantial completion.
  1. Failures include, but are not limited to, the following:
    - a. Software: Failure of input and output to execute switching or dimming commands.
    - b. Failure of modular relays to operate under manual or software commands.
    - c. Damage of electronic components due to transient voltage surges.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

#### 1.8 QUALITY ASSURANCE

- A. Product Qualifications
  1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
  2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
  3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
  4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
  5. All components and the manufacturing facility where product is manufactured must be RoHS compliant.
- B. Service and Support Requirements
  1. Phone Support: Toll free technical support shall be available.
  2. Remote Support: The contractor shall offer a remote support capability.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Acuity Brands Lighting, Inc.

### 2.2 SYSTEM DESCRIPTION

- A. Interface with HVAC DDC System: Hardware and software shall interface with HVAC DDC system to monitor, control, display, and record data for use in processing reports. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC."
1. Communication Interface: Comply with ASHRAE 135. Lighting System shall include gateway with BACnet IP communication to interface to the DDC System. Communication shall interface with HVAC DDC system to remotely control and monitor lighting from HVAC DDC system operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through DDC system for HVAC. This will include at a minimum all input values (i.e. - motion sensors, light level/photocell sensors, light status points, energy readings, etc.) and commanded values (lighting on/off, lighting dimming %, etc.). All output points available via the BACnet shall be writable, such that the BAS/DDC system can override lighting commands from the lighting system. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC."
- B. Surge Protective Device: Factory installed as an integral part of control components or field-mounted surge protective device complying with UL 1449, SPD Type 2.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- E. Comply with UL 916 and UL 924 standards where applicable.

### 2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
  2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
  3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect



networked luminaires with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections for each type of network connection, wired or wireless).

4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”
  - a. Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.
6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
2. Devices in an area shall be connected via a “daisy-chain” topology; requiring all individual networked devices to be connected back to a central component in a “hub-and-spoke” topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
7. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch

commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.

8. Wired networked Wall stations shall provide the follow Scene Control Capabilities:
  - a. Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
  - b. Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
  - c. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.

#### C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:
  - a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
  - b. The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.
  - c. The system shall support activation of pre-defined system Global Profiles.
2. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)
3. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

#### D. Supported Sequence of Operations

1. Control Zones
  - a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.
2. Wall station Capabilities
  - a. Wall stations shall be provided to support the following capabilities:
    - 1) On/Off of a local control zone.
    - 2) Continuous dimming control of light level of a local control zone.
  - b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.
3. Occupancy Sensing Capabilities

- a. Occupancy sensors shall be configurable to control a local zone.
- b. Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
- c. System shall support the following types of occupancy sensing sequence of operations:
  - 1) On/Off Occupancy Sensing
  - 2) Partial-On Occupancy Sensing
  - 3) Partial-Off Occupancy Sensing
  - 4) Vacancy Sensing (Manual-On / Automatic-Off)
- 4. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:
  - a. Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.
  - b. Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
  - c. To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.
  - d. Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
  - e. The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
- 5. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:
  - a. The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.
  - b. Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
  - c. To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
  - d. To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
  - e. Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.

- f. At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
6. To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

E. Photocell Sensing Capabilities (Automatic Daylight Sensing)

1. Photocell sensing devices shall be configurable to control a local zone.
  - a. The system shall support the following type of photocell-based control:
    - 1) Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

F. Schedule Capabilities

1. System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.
2. System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible "blink warning" 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.

G. Global Profile Capabilities

1. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting "Global Profiles" and is used to dynamically optimize the occupant experience and lighting energy usage.
2. Global profiles may be scheduled with the following capabilities:
  - a. Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
  - b. Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after "n" recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
  - c. Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
  - d. Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
  - e. Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
3. System Global Profiles shall have the following additional capabilities:

- a. Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.
    - b. Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
    - c. Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
  - 4. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.
- H. System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

## 2.4 SYSTEM SOFTWARE INTERFACES

### A. Visualization and Programming Interfaces

- 1. System shall provide an optional web-based visualization interface that displays graphical floorplan.
- 2. Graphical floorplan shall offer the following types of system visualization:
  - a. Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:
    - 1) Controls embedded light fixtures
    - 2) Controls devices not embedded in light fixtures
    - 3) Daylight Sensors
    - 4) Occupancy Sensors
    - 5) Wall Switches and Dimmers
    - 6) Scene Controllers
    - 7) Networked Relays
    - 8) Wired Bridges
    - 9) System Controllers
    - 10) Wired Relay Panels
    - 11) Group outlines
  - b. Group Only Option - A master graphic of the entire building, by floor, showing only control groups outlined.
  - c. Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor's master graphic.
  - d. A mouse click on any control device shall display the following information (as applicable):
    - 1) The device catalog number.
    - 2) The device name and custom label.
    - 3) Device diagnostic information.
    - 4) Information about the device status or current configuration is available with an additional mouse click.

## 2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

### A. System Controller

1. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
3. System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
4. System Controller shall perform the following functions:
  - a. Time-based control of downstream wired and wireless network devices.
  - b. Linking into an Ethernet network.
  - c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
  - d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
5. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
6. Device shall have option for a graphical touch screen to support configuration and diagnostics.
7. Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
  - a. The graphical touch screen
  - b. Wired communication bridges
  - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)
8. Device shall automatically detect all networked devices connected to it.
9. Device shall have an internal time clock used for astronomical and standard schedules.
10. Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.
  - a. Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices.
  - b. Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.
11. Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:
  - a. Hot Spot
  - b. Access Point
  - c. Client
12. Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
  - a. Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.
13. System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
  - a. BACnet MS/TP shall support 9600 to 115200 baud rate.
  - b. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
14. System controller shall contain a "FIPS 140-2 Level 1 Inside" cryptographic module.
15. System controller shall support RESTful API control of BACnet objects, user management, date and time, and file management.
16. System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation
  - a. Enclosure shall support power input power of 120-277VAC, or optional 347

B. Digital Electronic Time Clock (DTC)

1. Wired Networked Wall Switches, Dimmers, Scene Controllers

- a. Devices shall recess into single-gang switch box and fit a standard GFI opening.
  - b. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
  - c. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
  - d. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
  - e. Devices with mechanical push-buttons shall be made available with custom button labeling.
  - f. Wall switches & dimmers shall support the following device options:
    - 1) Number of control zones: 1, 2 or 4
    - 2) Control Types Supported:
      - a) On/Off
      - b) On/Off/Dimming
      - c) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
    - 3) Colors: Ivory, White, Light Almond, Gray, Black, Red
  - g. Scene controllers shall support the following device options:
    - 1) Number of scenes: 1, 2 or 4
    - 2) Control Types Supported:
      - a) On/Off
      - b) On/Off/Dimming
      - c) Preset Level Scene Type
      - d) On/Off/Dimming/Preset Level for Correlated Color Temperature
      - e) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
      - f) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
    - 3) Colors: Ivory, White, Light Almond, Gray, Black, Red
2. Wired Networked Graphic Wall Stations
- a. Device shall surface mount to single-gang switch box.
  - b. Device shall have a 3.5", capacitive full color touch screen.
  - c. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
  - d. Device shall have a micro-USB style connector for local computer connectivity.
  - e. Communication shall be over standard low voltage network cabling with RJ-45 connectors.
  - f. Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.
  - g. Device shall enable configuration of all switches, dimmers, control zones, and lighting preset scenes via password protected setup screens.
  - h. Graphic wall stations shall support the following device options:
    - 1) Number of control zones: Up to 16
    - 2) Number of scenes: Up to 16
    - 3) Profile type scene duration: User configurable from 5 minutes to 12 hours
    - 4) Colors: White, Black
3. Wired Networked Auxiliary Input / Output (I/O) Devices
- a. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.

- b. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
- c. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
  - 1) Contact closure or Pull High input
    - a) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
  - 2) 0-10V analog input
    - a) Input shall be programmable to function as a daylight sensor.
  - 3) RS-232/RS-485 digital input
    - a) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
  - 4) 0-10V dimming control output, capable of sinking up to 20mA of current
    - a) Output shall be programmable to support all standard sequence of operations supported by system.
  - 5) Digital control output via EdoLED LEDcode communication
    - a) Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.
- 4. Wired Networked Occupancy and Photosensors
  - a. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
  - b. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
  - c. Sensors shall utilize dual technology and one of its two technologies shall not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
  - d. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
  - e. System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.
  - f. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
  - g. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
  - h. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.
  - i. Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
  - j. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
  - k. Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
  - l. Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.



- m. Photosensor and dimming sensor's set-point and dead band shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
  - n. Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
  - o. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an "offset" from the primary zone.
- 5. Wired Networked Wall Switch Sensors
  - a. Devices shall recess into single-gang switch box and fit a standard GFI opening.
  - b. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
  - c. All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
  - d. Devices with mechanical push-buttons shall provide tactile user feedback.
  - e. Wall switches sensors shall support the following device options:
    - 1) User Input Control Types Supported: On/Off or On/Off/Dimming
    - 2) Occupancy Sensing Technology: PIR only or Dual Tech acoustic
    - 3) Daylight Sensing Option: Inhibit Photosensor
    - 4) Colors: Ivory, White, Light Almond, Gray, Black, Red
- 6. Wired Networked Embedded Sensors
  - a. Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
  - b. Occupancy sensor detection pattern shall be suitable for 7.5' to 20' mounting heights.
  - c. Embedded sensors shall support the following device options:
    - 1) Occupancy Sensing technology: PIR only or Dual Tech acoustic
    - 2) Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- 7. Wired Networked Power Packs and Secondary Packs
  - a. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
  - b. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
  - c. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
  - d. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
  - e. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
  - f. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
  - g. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
  - h. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

- i. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- j. Power/Secondary Packs shall be available with the following options:
  - 1) Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
  - 2) Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
  - 3) Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
  - 4) Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
  - 5) Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
  - 6) Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
  - 7) Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
  - 8) Secondary Pack capable of louver/damper motor control for skylights.
  - 9) Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
  - 10) Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
  - 11) Power Supply capable of providing auxiliary bus power (no switched or dimmed load).
- 8. Wired Networked Luminaires
  - a. Networked luminaire shall have a mechanically integrated control device.
  - b. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter).
  - c. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers).
  - d. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG and CCT capable versions).
  - e. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports "sleep mode."
  - f. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
  - g. System shall indicate (via a blink warning) when the LED luminaire is no longer able to compensate for lumen depreciation.
  - h. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
  - i. System shall be able to provide control of network luminaire intensity, in addition to dynamic features, such as grayscale and color accent of specific LED luminaires.
- 9. Wired Networked Bluetooth® Low Energy Programming Device
  - a. Device shall be plenum rated and be inline wired, screw mountable.
  - b. Communication and low voltage power shall be delivered to device via standard low voltage network cabling with RJ-45 connectors.
  - c. Bluetooth Low Energy connection shall allow connection from smartphone application for programming device settings within the local daisy-chain zone.

- 1) Device shall provide visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

## 2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than manufacturer's recommendation or requirements.
- B. Class 2 Control Cables: Multiconductor cable with copper conductor not smaller than manufacturer's recommendation or requirements.
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than manufacturer's recommendation or requirements.
- D. Digital and Multiplexed Signal Cables: UTP cable with copper conductors, complying with Category 5e for horizontal copper cable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Installation Procedures and Verification
  1. The contractor shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
  2. The contractor shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
- B. Coordination with Owner's IT Network Infrastructure
  1. The contractor is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
    - a. The contractor shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
    - b. The contractor shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.
- C. Documentation and Deliverables
  1. The contractor shall document installed location of all networked devices, including networked luminaires. This includes providing as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
  2. The contractor is responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
    - a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.

- b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
  - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
    - a) Titleblock
    - b) Text- Inclusive of room names and numbers, fixture tags and drawings notes
    - c) Fixture wiring and homeruns
    - d) Control devices
    - e) Hatching or poché of light fixtures or architectural elements
  - 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

### 3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method:
  - 1. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
  - 2. Where run exposed, wiring shall be in surface mounted metallic wiremold.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Label each device cable within **6 inches** of connection to power supply or termination block.

### 3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
  - 1. Test continuity of each circuit.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. The contractor shall be responsible for testing of all low voltage network cable included in the bid. Contractor is responsible for verification of the following minimum parameters:
    - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
    - b. Length
    - c. Insertion Loss

2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
  3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Lighting controls will be considered defective if they do not pass tests and inspections.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service. This shall be included in the base bid and not be cause for an extra.
1. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
    - a. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.
  2. System start-up and programming shall include:
    - a. Verifying operational communication to all system devices.
    - b. Programming the network devices into functional control zones to meet the required sequence of operation.
    - c. Programming and verifying all sequence of operations.
  3. Initial start-up and programming is to occur on-site.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control units and operator interface.

END OF SECTION 260943



## SECTION 262200 – LOW-VOLTAGE TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1500 kVA:
  - 1. Distribution transformers.
    - a. High efficiency copper-wound transformer with 25% less loss than 2016 DOE standards.
    - b. The transformer shall retain its 2016 DOE standard values.
- B. Ratings:
  - 1. KVA ratings as designated on the drawings.
  - 2. Primary voltage 480 volts delta, unless otherwise noted.
  - 3. Secondary voltage 208 Y/120 volts wye, unless otherwise noted.
- C. Construction:
  - 1. Completely factory assembled, testing, and conform to NEMA TP-1, UL, and NEC standards.
  - 2. Exterior and interior steel surfaces properly cleaned and finished with ANSI-61 gray paint over a rust inhibiting phosphatized coating.

#### 1.3 SUBMITTALS

- A. Submit product data including nameplate data, detailed enclosure dimensions, minimum clearances, kVA ratings, primary & secondary nominal voltages, voltage taps, insulation class, temperature rise, core and coil materials, impedances, audible noise level, BIL, unit weight, quality assurance program, UL and other applicable agency certifications, warranty, packaging method for shipment.
  - 1. For standard transformers submit the following additional information:
    - a. Linear load Efficiency data @ 25%, 50%, 75%, 100%.
    - b. Linear Load Efficiency per NEMA TP-1 @35% of nameplate rating.
    - c. No load and full load losses per NEMA ST20

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Source quality-control test reports.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For transformers to include in operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution Transformers."
- D. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting 2016 DOE standards,
  - 1. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

#### 1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.



## PART 2 - PRODUCTS

2.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 MANUFACTURERS

- A. Manufacturers:
  - 1. General Electric Company.
  - 2. Square D; Schneider Electric.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 5. Or approved equal.

### 2.3 GENERAL TRANSFORMER REQUIREMENTS: Provide copper windings.

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Copper.
- A. The transformers shall have a minimum of four (4) 2½% full capacity taps.
- B. The transformer shall be a minimum of 115°C temperature rise above 40°C ambient.
- C. All insulating materials to be in accordance with NEMA ST20 Standards for a 220°C UL component recognized insulation system.
- C. Transformer coils shall be of continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.
- D. The enclosure shall be heavy gauge, sheet steel, ventilated, and shall be degreased, cleaned, phosphatized primed, and finished with a gray, baked enamel.
- E. The maximum exterior temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.
- F. The transformer shall be visibly grounded to the enclosure in accordance with NEMA, IEEE, and ANSI Standards.
- G. Sound levels shall be guaranteed by the manufacturer not to exceed 55 db.
- H. Provide low noise type for K-13 transformers.

## 2.4 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Ventilated, NEMA 250, Type 2, unless otherwise noted on drawings.
  - 1. Core and coil shall be encapsulated within resin compound and Vacuum Pressure Impregnated (VPI), sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: Gray .
- F. Taps for Transformers Smaller than 3 kVA: None.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with 2016 DOE efficiency levels.
  - 2. Tested according to NEMA TP 2.
  - 3. Dry type distribution transformer shall have characteristics and features as shown in Table 2.

Kva RATING	Table 1 and indicated on drawings
Input voltage	480 volt delta
Output voltage	208 volt, three phase, 4 wire wye
Insulation class	220 °C
Temperature class	115 °C
Mechanical	Core and coil
Winding material	Copper
Electrostatic shield	Yes
Taps	2 x 2.5% FCAN, 4 x 2.5% FCBN
Enclosure	Type 1
Energy efficiency rating	TP1, Energy Star ©

- K. Wall Brackets: Manufacturer's standard brackets.
- L. Fungus Proofing: Permanent fungicidal treatment for coil and core.

- M. Low-Sound-Level Requirements: Meet NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

## 2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

## 2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct type-tests for sound-level performance of equipment for this Project.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration Controls for Electrical Systems."
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration Controls for Electrical Systems."
- C. Transformers noted on located in sound restricted areas ,i.e. adjacent to office work spaces, public areas and court or hearing rooms, shall be mounted on vibration isolators and oriented not parallel to adjacent walls. Install grounding as required by NEC.

- D. Set taps to position as directed following testing.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
  - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

### 3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

### 3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

### 3.7 TESTING

- A. Completely test under full load conditions and take voltage and ampere readings of each phase.

### 3.8 COMPLETION

- A. Completely clean, vacuum, and wipe down interior and exterior of entire assembly prior to energizing and again prior to final acceptance.
- B. Paint all nicks, scratches, dents, unpainted bolt heads, etc. with two (2) coats of matching paint to the approval of the Design Consultant.

END OF SECTION 262200



## SECTION 262413 – SWITCHBOARDS

### PART 1 - GENERAL

#### 1.1 REFERENCES

- A. NEMA, and UL 891.
- B. National Electrical Manufacturers Association (NEMA):
  - 1. AB-1 Molded Case Circuit Breakers.
  - 2. PB-2 - Deadfront Distribution Switchboards.
  - 3. PB2.1 - General Instructions For Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- C. Underwriters Laboratories Inc.:
  - 1. UL50 - Electrical Cabinets and Boxes.
  - 2. UL67 - Electric Panelboards.
  - 3. UL489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.
  - 4. UL869 - Electrical Service Equipment.
  - 5. UL891 - Dead-Front Switchboards.
- D. Underwriters Laboratories Inc.:
  - 1. UL50 - Electrical Cabinets and Boxes.
  - 2. UL67 - Electric Panelboards.
  - 3. UL489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.
  - 4. UL869 - Electrical Service Equipment.
  - 5. UL891 - Dead-Front Switchboards.
- E. IEEE:
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial Commercial Power Systems.
  - 2. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
  - 3. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
- F. ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation

#### 1.2. DEFINITIONS

- A. ITIC (Information Technology Industry Council) Curve: Describes how much or how little voltage IT equipment can sustain without damage and over what length of time.

#### 1.3 SUMMARY

- A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

## 1.2 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
  1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
  2. Detail enclosure types for types other than NEMA 250, Type 1.
  3. Detail bus configuration, current, and voltage ratings.
  4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
  5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
  6. Detail utility company's metering provisions with indication of approval by utility company.
  7. Include evidence of NRTL listing for series rating of installed devices.
  8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
  10. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Product Data:
  1. Catalog sheets, specifications and installation instructions.
    - a. For devices equipped with ground fault protection, include information sheets describing system testing instructions and test form which comply with UL 891 requirements.
  2. Bill of materials.
  3. Name, address and telephone number of nearest fully equipped service organization.
- D. Quality Control Submittals:
  1. Company Field Advisor Data: Include:
    - a. Name, business address and telephone number of Company Field Advisor secured for the required services.



- b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
- c. Services and each product for which authorization is given by the Company listed specifically for this project.

2. Electric Utility Company Approval:

- a. Submit shop drawings and product data to the electric utility company for approval:

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- b. After shop drawings and product data have been approved by the electric utility company, forward two copies with utility company letter indicating approval.

- c. Metering enclosures will not be approved until electric utility company approval is received. Submit (2) – sets of shop drawings and product data to the electric utility company for approval prior to equipment order.

E. Contract Closeout Submittals:

- 1. System acceptance test report.
- 2. Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.
- 3. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Engineer.

F. Field Quality-Control Reports:

- 1. Test procedures used.
- 2. Test results that comply with requirements.
- 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

- 1. Routine maintenance requirements for switchboards and all installed components.
- 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- 3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

H. The short-circuit, protective device coordination and arc-flash hazard studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

- I. Short Circuit Analysis/Protective Relay Coordination/Arc-Flash Hazard Analysis Study:
  1. The Contractor secure the services of the Switchgear Component Manufacturer Field Advisor in order to perform a complete and thorough power study/analysis of the completed feeder circuit breakers for the purpose of determining all proper system protective relay settings and to implement these settings. The study will continue with analysis of the connection of feeders to Switchboard via Transformers. Arc-Flash Hazard Analysis will be performed to include the branch circuit connections at Switchboard.
  2. The completed study shall be submitted for review and approval by the Engineer prior to the implementation of any relay settings. This study shall be conducted under the applicable standards of the American National Standards Institute (ANSI) and the National Electrical Code (NEC) which shall include, but is not limited to:
    - a. Short-Circuit Analysis: Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the proposed power distribution system - beginning at the primary and secondary terminals of padmounted Transformers, Switchboard, Generator Switchboard and Branch Circuit Panelboards.
      - 1) Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
      - 2) A printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
      - 3) The study shall include input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
      - 4) Identification of the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
      - 5) The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the analysis.

- 6) A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- 7) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
- 8) Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

b. Short-Circuit Analysis: Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the proposed power distribution system - beginning at the primary and secondary terminals of padmounted Transformers, Switchboard, Generator Switchboard and Branch Circuit Panelboards.

- 1) Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
- 2) A printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
- 3) The study shall include input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
- 4) Identification of the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
- 5) The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the analysis.

- 6) A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- 7) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
- 8) Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

b. Protective Device Coordination Analysis:

- 1) The time-current coordination analysis shall be performed and will include the determination of settings, ratings, or types for the overcurrent protective devices supplied.
- 2) Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection and service continuity considered to be of equal importance.
- 3) Sufficient analysis shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
- 4) Provide log-log plots containing descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
- 5) The study shall include a separate listing of the suggested device settings of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.
- 6) A computer-generated system one-line diagram shall be provided which clearly identifies individual equipment uses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
- 7) A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

- 8) Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.
- 9) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the time-current analysis to be completed prior to final installation.
- c. Arc-Flash Hazard Analysis:
  - 1) The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
  - 2) The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
  - 3) Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
  - 4) The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
  - 5) The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.
  - 6) The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations - NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.
  - 7) The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
  - 8) The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analyses it has performed in the past year.
  - 9) The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
  - 10) The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2011 Section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.
- d. Report which shall contain the following information:
  - 1) Executive summary identifying all work performed, along with any future design considerations.
  - 2) A complete tabulation of all protective devices identified on the single line diagram with their ratings compared with respective fault duty as calculated in the study.
  - 3) A complete tabulation of the settings recommended on all adjustable protective devices with references to the single line diagram and coordination curves.
  - 4) Copies of all time/current coordination curves.
  - 5) The analysis that was utilized in order to arrive at specified recommendations included in the executive summary.
  - 6) The single line diagram complete.
  - 7) Copies of all calculations and computer analysis results referenced to the single line diagram.
  - 8) Incident energy and flash protection boundary calculations
  - 9) Complete documentation of all testing results.
  - 10) Printed hard copy arc flash labels with electronic format copy.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. If switchboards are stored in unheated conditions, remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NECA 400.
- D. Protection: Provide supplemental heating devices, such as incandescent lamps or low wattage heaters within the enclosure or under a protective cover to control dampness. Maintain this protection from the time equipment is delivered to the site until it is energized.

#### 1.5 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
  - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Submit drawings showing the location of electrical equipment supplied as part of this specification section that requires work space clearance in accordance with NFPA 70 Article 110 Part II. Work space clearance, including height, shall be indicated on the drawing, indicating where other trades are restricted from locating equipment, ductwork or piping. Locations for equipment furnished under this section may be shown on consolidated drawings submitted under Division 26 Section. These drawings shall be coordinated with the other trades through the General Contractor. Any changes to these drawings during the course of the construction shall be coordinated with all trades through the General Contractor prior to installing the equipment. Changes required by other trades as a result of lack of coordination through the General Contractor shall be borne by the Electrical Contractor.
- C. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  2. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

5. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Front-Connected, Front-Accessible Switchboards:
  1. Main Devices: Panel mounted.
  2. Branch Devices: Panel mounted.
  3. Sections front and rear aligned.
  4. Front accessibility.
  5. Sections flush at rear (rear alignment).
  6. Main device: Stationary circuit breaker (see circuit breaker paragraph).
  7. Provisions for electric utility company metering current transformers. The utility current transformer compartment shall comply with Public Service Electric & Gas (PSE&G) construction specifications.
  8. Fully rated copper bus bars.
    - a. Ampere rating of through bus not less than frame size of main device.
  9. Full length copper ground bus.
  10. Full capacity copper neutral bus.
  11. Sections that are designated "space" or "provision for future breaker" equipped with all accessories required to accept a future circuit breaker.
  12. Space heaters with thermostatic control.
  13. Circuit Breakers:
    - a. Mounting: Group mounted, or individually mounted as necessary to accommodate the circuit breaker style and switchboard construction.
    - b. Style: Molded case, or power circuit breakers, as required to accommodate the circuit breaker components.
    - c. Trip Device: Programmable solid state.
    - d. Interrupting Capacity: Equal to, or greater than, the short circuit rating required for the switchboard.
    - e. Component Description: See switchboard schedule for specific components required for each circuit breaker. In addition to the specific components, equip each circuit breaker with additional components as required to achieve a coordinated selective scheme between the main device and the feeder devices
- C. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Indoor Enclosures: Steel, NEMA 250, Type 1.

- E. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- F. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- H. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- I. Pull Box on Top of Switchboard:
  - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
  - 2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
  - 3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
  - 4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- J. Buses and Connections: Three phase, four wire unless otherwise indicated.
  - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
  - 2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
  - 3. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
  - 4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
  - 5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- K. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- L. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.



## 2.2 SURGE PROTECTIVE DEVICES

- A. General: Where indicated on the drawings, the switchboards shall be provided with factory installed directly to bus, internal modular Surge Protective Device (SPD) equipment having:
1. ANSI/UL 1449 3rd Edition compliant – Listed Category C, Type 2 with protected modes for 3 phase, 4 wire Wye configured system: L-G, L-N, L-L and N-G.
  2. Rating (ANSI / IEEE C62.41 location Category C): The minimum surge current capacity the device is capable of withstanding shall be 250 kA per phase, 125 kA per mode minimum.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Controlled Power
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  4. Siemens Energy & Automation, Inc.
  5. Square D; a brand of Schneider Electric.
  6. Or Approved Equal.
- C. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
1. Fabrication using bolted compression lugs for internal wiring.
  2. Redundant suppression circuits.
  3. Redundant replaceable modules.
  4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  5. LED indicator lights for power and protection status.
  6. Audible alarm, with silencing switch, to indicate when protection has failed.
  7. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- D. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
- E. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
- F. Protection modes and UL 1449 SVR for grounded wye circuits with 208/120 -V, three-phase, four-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 208/120
  2. Line to Ground: 800 V for 208/120 .
  3. Neutral to Ground: 800 V for 208/120

## 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    - f. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
    - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - i. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- B. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
1. Fixed circuit-breaker mounting.
  2. Two-step, stored-energy closing.
  3. Standard -function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time time adjustments.
    - c. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  5. Remote trip indication and control.

6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  7. Control Voltage: 120-V ac.
- C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    - b. Siemens Energy & Automation, Inc.
    - c. Square D; a brand of Schneider Electric.
    - d. Or Approved Equal.
  2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
  3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
    - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
  4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
  5. Service-Rated Switches: Labeled for use as service equipment.
  6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
    - a. Configuration: Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
    - c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
    - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
  7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- D. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    - b. Or Approved Equal.
  2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.

3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
    - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
  4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
  5. Service-Rated Switches: Labeled for use as service equipment.
  6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
    - a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
    - c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
    - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
  7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- E. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- F. Fuses are specified in Division 26 Section "Fuses."

## 2.4 INSTRUMENTATION

- A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound, bushing, bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
  2. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
  3. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 1 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    - d. Megawatts: Plus or minus 2 percent.
    - e. Megavars: Plus or minus 2 percent.

- f. Power Factor: Plus or minus 2 percent.
    - g. Frequency: Plus or minus 0.5 percent.
    - h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
    - i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
    - j. Contact devices to operate remote impulse-totalizing demand meter.
  - 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
- C. Impulse-Totalizing Demand Meter:
- 1. Comply with ANSI C12.1.
  - 2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
  - 3. Cyclometer.
  - 4. Four-dial, totalizing kilowatt-hour register.
  - 5. Positive chart drive mechanism.
  - 6. Capillary pen holding a minimum of one month's ink supply.
  - 7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
  - 8. Capable of indicating and recording 15 -minute integrated demand of totalized system.

## 2.5 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

## 2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA Publication No. PB2.1.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install switchboards in accordance with NEMA Publication No. PB2.1 "Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards".
  - 1. Set and program the switchboard devices in accordance with the approved coordinated selective scheme.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch minimum nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete".
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Identification:
  - 1. Install on the front of each circuit breaker, a phenolic nameplate indicating load served by circuit breaker.
  - 2. Stencil on front of each switchboard with white paint in 1/2 inch lettering "SB-1, etc." corresponding to switchboard designations on the drawings, and electrical parameters (phase, wire, voltage).
- H. Grounding: Connections: Ground switchgear ground bus to common building ground as indicated on the Drawings.
- I. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where these values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Switchboard will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as recommended by manufacturer.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413



## SECTION 262416 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 REFERENCES

- A. The latest edition of: NEMA PB-1, UL-50, UL-67, ANSI C37.81.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Electronic-grade panelboards.

#### 1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. MCCB: Molded-case circuit breaker
- C. SS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
- C. Quality Control Submittals:

1. List of Completed Installations: If brand names other than those specified are proposed for use, furnish the name, address, and telephone number of at least 5 comparable installations that can prove the proposed products have operated satisfactorily for one year.
  2. Company Field Advisor Data: Include:
    - a. Name, business address and telephone number of Company Field Advisor secured for the required services.
    - b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
    - c. Services and each product for which authorization is given by the Company listed specifically for this project.
- D. Contract Closeout Submittals:
1. System acceptance test report.
  2. Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.
1. 3. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Engineer
- E. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."
- F. Qualification Data: For qualified testing agency.
- G. Field Quality-Control Reports:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- H. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- I. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards. If panelboards are stored in an unconditioned area during cold weather, install temporary electric heating (1 W per 250 cubic inches of panelboard space) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Architect, Construction Manager and Owner no fewer than (14) fourteen days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Construction Manager's written permission.
  - 3. Comply with NFPA 70E.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: One spare of each type for each panelboard. Size shall be the most common size in the panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - b. Outdoor Locations: NEMA 250, Type 3R.
  - c. Kitchen and Wash-Down Areas: NEMA 250, Type 3R.
  - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Finishes:
  - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - b. Back Boxes: Galvanized steel.
  - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

- B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Neutral Bus: Neutral bus rated 100 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Neutral Lugs: Rated 100 percent of phase lugs mounted on neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: All spaces shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. As produced by Cutler-Hammer/Eaton Corp. with LT Trim (Eaton EZ Trim shall not be considered), General Electric Co., Siemens or Square D Co., having:

1. Flush or surface type cabinets as indicated on the drawings.
2. Increased gutter space for gutter taps, sub-feed wiring, through-feed wiring, oversize lugs.
3. SUITABLE FOR USE AS SERVICE EQUIPMENT where used as service equipment.
4. Door and one piece trim. Door fastened to trim with butt or piano hinges. Trim fastened to cabinet with devices having provision for trim adjustment.
5. Yale No. 511S locks with brass cylinder rosette, blind fastened from inside of door. 2 No. 47 keys with each lock (Exception: Not more than 7 keys, total) or approved equal.
6. Solid copper bus bars. Ampere rating of bus bars not less than frame size of main circuit breaker.
7. Ratings as indicated on the drawings.
8. Full capacity copper neutral bus where neutrals are required.
9. Copper equipment grounding bus.
10. Sections designated "space" or "provision for future breaker" equipped to accept future circuit breakers.
11. Lock on devices for exit light, fire alarm, stair well circuits.
12. Provisions for padlocking circuit breaker handle in OFF position where indicated.
13. Directory.

14. Short circuit rating not less than indicated on panelboard schedule. Furnish fully rated equipment (the short circuit rating of the panelboard is equal to the lowest interrupting rating of any device installed in the panelboard).
15. Thermal magnetic, molded case, bolt-on circuit breakers:
  - a. Mounting: Individually mounted main circuit breaker (when MCB is required), and group mounted branch/feeder circuit breakers to accommodate the circuit breaker style and panelboard construction.
  - b. Components: See panelboard schedule for specific components required for each circuit breaker. In addition to the specific components, equip each circuit breaker with additional components as required to achieve a coordinated selective scheme between the main circuit breaker and the branch/feeder circuit breakers.
  - c. Single pole 15 ATE and 20 ATE circuit breakers marked SWD where used as switches.
  - d. Single pole and two pole 15, 20, and 30 ATE circuit breakers rated for high intensity discharge lighting loads when applicable.

## 2.3 NAMEPLATES

- A. General: Precision engrave letters and numbers with uniform margins, character size minimum 3/16 inch high.
  1. Phenolic: Two color laminated engravers stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## 2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or Lugs only as shown on drawings.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as shown on drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 ELECTRONIC-GRADE PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Panelboards: NEMA PB 1; with factory-installed, integral SS; labeled by an NRTL for compliance with UL 67 after installing SS.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- F. Buses:
  - 1. Copper phase and neutral buses; 100 percent capacity neutral bus and lugs.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Shunt Trip: 24 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    - h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.



- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
  - 1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
  - 2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
  - 3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

## 2.6 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Current Technology; a subsidiary of Danahar Corporation.
  - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 4. Liebert Corporation.
  - 5. Siemens Energy & Automation, Inc.
  - 6. Square D; a brand of Schneider Electric.  
Or Approved Equal.
- B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
  - 1. Accessories:
    - a. Fuses rated at 250-kA interrupting capacity.
    - b. Fabrication using bolted compression lugs for internal wiring.
    - c. Integral disconnect switch.
    - d. Redundant suppression circuits.
    - e. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
    - f. LED indicator lights for power and protection status.
    - g. Audible alarm, with silencing switch, to indicate when protection has failed.
    - h. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
  - 2. Peak Single-Impulse Surge Current Rating: 125 kA per mode/250 kA per phase.
  - 3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
    - a. Line to Neutral: 70,000 A.
    - b. Line to Ground: 70,000 A.
    - c. Neutral to Ground: 50,000 A.
  - 4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
  - 5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 or 208Y/120 -V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral: 800 V for 480Y/277 or 400 V for 208Y/120.

- b. Line to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.
- c. Neutral to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards in accordance with NEMA Publication No. PB1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards in accordance with NEMA Publication No. PB1.1 "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".
- B. Flush Cabinets: Set flush cabinets so that edges will be flush with the finished wall line. Where space will not permit flush type cabinets to be set entirely in the wall, set cabinet as nearly flush as possible, and cover the protruding sides with the trim extending over the exposed sides of the cabinet and back to the finished wall line.
- C. Directory: Indicate on typewritten directory the equipment controlled by each circuit breaker, and size of feeder servicing panelboard. For power panelboards also include ATE rating and feeder size for each breaker.
- D. Remove the neutral to ground main/system bonding jumper unless the panelboard is used for a service entrance or if the panel is fed by a separately derived system. Turn the bonding jumper over to the Engineer.
- E. Identification:
  - 1. Use nameplates, or stencil on front of each panelboard with white paint, "LV-1\*", HV-1\*", etc." in 1/2 inch lettering corresponding to panelboard designations on the drawings, and electrical parameters (phase, wire, voltage).

2. Install a nameplate on each panelboard that explains the means of identifying each ungrounded system conductor by phase and system. Examples of nameplate statements:
  - a. Identification of 120/208 Volt Circuit Conductors:  
2 wire circuit - white\*, black, white.  
3 wire circuit - white\*, black, red, white.  
4 wire circuit - white\*, black, red, blue, white

\*White is used only as neutral. Where neutral is not required, black, red, or black, red, blue is used for phase to phase circuits.

- b. Identification of 277/480 Volt Circuit Conductors:  
2 wire circuit - natural gray\*\*, brown, gray.  
3 wire circuit - natural gray\*\*, brown, yellow, gray.  
4 wire circuit - natural gray\*\*, brown, yellow, orange, gray

\*\*Natural gray is used only as neutral. Where neutral is not required, brown, yellow, or brown, yellow, orange is used for phase to phase circuits.

- A. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
- B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- C. Install overcurrent protective devices and controllers not already factory installed.
  1. Set field-adjustable, circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- F. Arrange conductors in gutters into groups and bundle and wrap loosely with wire ties after completing load balancing.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing of surge suppressors and other electronic devices with adjustment capabilities.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit. ANY PANEL WITH INTEGRAL SS UNIT SHALL HAVE SS UNIT DISCONNECTED PRIOR TO ANY MEGGAR TESTING.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416



## SECTION 262713 – ELECTRICITY METERING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes equipment for electricity metering.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts and wiring diagrams.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data. In addition to items specified in Division 1 include the following:
  - 1. Application and operating software documentation.
  - 2. Software licenses.
  - 3. Software service agreement.
  - 4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.6 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to the Authority to allow scheduling and access to system and to allow the Authority to upgrade his computer equipment if necessary.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by utility company.

- B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- C. Meter Sockets: Comply with requirements of electrical-power utility company.
- D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install modular meter center according to NECA 400 switchboard installation requirements.
- D. Comply with requirements for identification specified in Division 26.
  - 1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
  - 2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for typewritten card with occupant's name.

#### 3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
  - 2. Turn off circuits supplied by metered feeder and secure them in off condition.
  - 3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
  - 4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
- C. Electricity metering will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262713



## SECTION 262726 – WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Wall-box motion sensors.
  - 3. Snap switches and wall-box dimmers.
  - 4. Wall-switch and exterior occupancy sensors.
  - 5. Cord and plug sets.
  - 6. Multioutlet assemblies.
- B. Related Sections include the following:
  - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

## 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
  - 5. Or Approved Equal.

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
    - e. Or Approved Equal.

## 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; XGF20.
    - b. Hubbell; GF5352.
    - c. Leviton; 6898.
    - d. Pass & Seymour; 2084.
    - e. Bryant
    - f. Or Approved Equal.

## 2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Furnished on equipment provided by owner.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.5 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 2221PL for 120 V and 277 V.
    - b. Hubbell; HPL1221PL for 120 V and 277 V.
    - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper; 2221L.
  - b. Hubbell; HBL1221L.
  - c. Leviton; 1221-2L.
  - d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 RECEPTACLES

A. Specification Grade Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5251, Crouse-Hinds/AH's 5251, Hubbell's 5251, Leviton's 5251, Pass & Seymour's 5251, or approved equal.
2. Duplex receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5252/5242, Crouse-Hinds/AH's 5252/5242, Hubbell's 5252/5242, Leviton's 5252/5242, Pass & Seymour's 5252/5242, or approved equal.
3. Single receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5361/5351, Crouse-Hinds/AH's 5361/5351, Hubbell's 5361/5351, Leviton's 5361/5351, Pass & Seymour's 5351, or approved equal.
4. Duplex receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5362, Crouse-Hinds/AH's 5352/5342, Hubbell's 5352, Leviton's 5352, Pass & Seymour's 5352, or approved equal.

B. Electric Clock Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W), brass or stainless steel face plate to match hardware; Bryant's 2828-G, 2828-GS, Crouse-Hinds/AH's 5708, Hubbell's 5233, 5235, Leviton's 5261-CH, Pass & Seymour's S3733, S3733-SS, or approved equal.

C. Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Bryant's GFR52FT, Crouse-Hinds/AH's GF5242, Hubbell's GF5252, Leviton's 6599, Pass & Seymour's 1591S, Daniel Woodheads 5252GF, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Bryant's GFR53FT, Crouse-Hind/AH's GF5342, Hubbell's GF 5352, Leviton's 6899, Pass & Seymour's 2091S, Daniel Woodheads 5352GF, or approved equal.

D. Weather Resistant Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Cooper's WRVGF15W, Leviton's 002-W7599-00W, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Cooper's WRVGF20W, Leviton's 002-W7899-00W, or approved equal.

E. Special Purpose Receptacles: Furnish matching nylon, polycarbonate or armored plug with each receptacle. Furnish matching wall plate with each receptacle (.040" brass, Type 302 stainless steel, weatherproof, threaded box type, as required):

1. Type A: NEMA 14-20R (3P, 4W, 20A, 125/250 V, W/G); Crouse-Hinds/AH's 5759, General Electric's 1420, Hubbell's 8410, or approved equal
2. Type B: NEMA 14-30R (3P, 4W, 30A, 125/250 V, W/G); Bryant's 9430FR, Crouse-Hinds/AH's 5744N, Hubbell's 9430A, Leviton's 278, Pass & Seymour's 3864, or approved equal.
3. Type C: NEMA 14-50R (3P, 4W, 50A, 125/250 V, W/G); Bryant's 9450FR, Crouse-Hinds/AH's 5754N, Hubbell's 9450A, Leviton's 279, Pass & Seymour's 3894, or approved equal.
4. Type D: NEMA 14-60R (3P, 4W, 60A, 125/250 V, W/G); Bryant's 9460FR, Crouse-Hinds/AH's 9460N, Hubbell's 9460A, Pass & Seymour's 3871, or approved equal.
5. Type E: NEMA 10-20R (3P, 3W, 20A, 125/250 V); Bryant's 9326, Crouse-Hinds/AH's 9140, Hubbell's 6810, Pass & Seymour's 6810, or approved equal.
6. Type F: NEMA 10-30R (3P, 3W, 30A, 125/250 V); Bryant's 9303, Crouse-Hinds/AH's 9344N, Hubbell's 9350, Leviton's 5207, Pass & Seymour's 3860, or approved equal.
7. Type G: NEMA 10-50R (3P, 3W, 50A, 125/250 V); Bryant's 9306, Crouse-Hinds/AH's 7985N, Hubbell's 7962, Leviton's 5206GR, Pass & Seymour's 3890, or approved equal.
8. Type H: NEMA L5-15R (2P, 3W, 15A, 125 V, W/G); Bryant's 4710, Crouse-Hinds/AH's 4710, Hubbell's 4710, Pass & Seymour's 4710, or approved equal.
9. Type I: NEMA L5-20R (2P, 3W, 20A, 125 V, W/G); Bryant's 70520FR, Crouse-Hinds/AH's 6200, Hubbell's 2310A, Pass & Seymour's L520-R, or approved equal.
10. Type J: NEMA L5-30R (2P, 3W, 30A, 125 V, W/G); Bryant's 70530FR, Crouse-Hinds/AH's 6330, Hubbell's 2610A, Leviton's 70530-FR, Pass & Seymour's L530-R, or approved equal.
11. Type K: NEMA L6-15R (2P, 3W, 15A, 250 V, W/G); Bryant's 70615FR, Crouse-Hinds/AH's 6560, Hubbell's 4560, Leviton's 70615FR, Pass & Seymour's 4560, or approved equal.
12. Type L: NEMA L6-20R (2P, 3W, 20A, 250 V, W/G); Bryant's 70620FR, Crouse-Hinds/AH's 6210, Hubbell's 2320A, Leviton's 70620-FR, Pass & Seymour's L620-R, Slater's L620R, or approved equal.
13. Type M: NEMA L6-30R (2P, 3W, 30A, 250 V, W/G); Bryant's 70630FR, Crouse-Hinds/AH's 6340, Hubbell's 2620, Pass & Seymour's L630-R, or approved equal.

## 2.6 WALL PLATES

### A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting .
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with lift cover, and listed and labeled for use in "wet locations while in use."

Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant while in use, die-cast aluminum with lockable cover.

### B. Brass Wall Plates: .040 inch thick brass with brush brass finish; Bryant's 518 Series, Hubbell's B Series or 94 Series, Leviton's 81 Series, Pass & Seymour's B Series, or approved equal.

- C. Stainless Steel Wall Plates: Type 302 stainless steel with satin finish; Bryant's 93 Series, Crouse-Hinds/AH's 93 Series, Hubbell's 93 Series, Leviton's 910 -40 Series, Pass & Seymour's 93 Series, or approved equal.
- D. Weatherproof Covers: Crouse-Hinds WLRS, WLRD, Hubbell's 52, 74 Series, Pass & Seymour's 45 Series, or approved equal.
- E. Weatherproof While In Use Covers:
  - 1. Polycarbonate: Cooper Crouse-Hinds TP7488W, Pass & Seymour's (Legrand) WIUC10C, or approved equal.
  - 2. Metallic: Hubbell's WP826 or WP826H, Thomas and Betts' (Red Dot) CKMUV or CKMU, Leviton's M5979-0GY or M5999-0GY, or approved equal
- F. Covers for Threaded Type Boxes: Stamped sheet steel, gasketed device covers as produced by Crouse-Hinds Co., OZ/Gedney Co., or approved equal.+++++++

## 2.7 EMERGENCY SHUTDOWN SWITCHES

- A. Emergency Shutdown Pushbutton Switch: Square D. Co.'s Class 9001 or approved equal, Type K, pushbutton operator with the following:
  - 1. Red mushroom button.
  - 2. Transformer type red pilot light.
  - 3. Legend red plate with words "Emerg. Stop".
  - 4. NEMA 13 oil tight enclosure with cover riveted to box.
- B. Emergency Shutdown Key Operated Switch: Square D. Co.'s Class 9001 or approved equal, Type K, key operated selector switch with the following:
  - 1. Key removable in both "ON" and "OFF" position.
  - 2. NEMA 13 oil tight enclosure with cover riveted to box.

## 2.8 NAMEPLATES

- A. Phenolic Type: Standard phenolic nameplates with 3/16 inch minimum size lettering engraved thereon.
- B. Embossed Aluminum: Standard stamped or embossed aluminum tags, 3/16 inch minimum size lettering, as produced by Seton Name Plate Corp. or Tech Products Inc.

## 2.9 FLOOR SERVICE FITTINGS

- A. Service fittings in first paragraph below are available for voice and data communication cabling as well as for power. Edit to suit Project.
- B. Type: Modular, flush-type , dual-service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Round, solid brass with satin finish.

- E. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish for general receptacles; white for computer receptacles, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

## 2.10 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Wiremold Company (The).
  - 3. Or Approved Equal.
- B. If not indicated on Drawings, add mounting heights, raceway sizes, and types and spacing of receptacle devices to paragraph below. Add descriptions of special features in assemblies such as fused receptacles, special-purpose switches, and channels for communication wiring.
- C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: As shown on plans.
- E. Wire: No. 12 AWG.

## 2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices connected for general duty shall be grey; connected for computers shall be white, unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Install wiring devices in outlet boxes.
- B. Local Switches:
  - 1. Install local switches rated 15A, 120/277 V ac for switches unless otherwise shown on the drawings or specified.
  - 2. Install switches indicated Sa, Sb, Sc, etc, for control of outlets, with corresponding letters on the same circuit.
  - 3. Where more than one switch occurs at same location in a 120 volt system, arrange switches in gangs and cover with one face plate.
  - 4. Install switches in a 277 volt system in separate single boxes if voltage between exposed live metal parts of adjacent switches exceeds 300 volts.

5. Install single and double pole switches so that switch handle is up when switch is in the "On" position.
  6. Install key operated switches where shown on the drawings.
- C. Receptacles:
1. Install Specification Grade receptacles, NEMA 5-15R, 15A, 125 V, 2P, 3W, for duplex receptacles and single receptacles unless otherwise shown on the drawings or specified.
  2. Install receptacles with ground pole in the down position.
  3. Install Weather Resistant Ground Fault Interrupter Receptacles in wet and damp locations.
- D. Wall Plates:
1. Install wall plates on all wiring devices in dry locations, with finish to match hardware in each area.
  2. Install hospital wall plates on Type HG receptacles.
  3. Install blank wall plates on outlet boxes which are for future equipment except telephone outlets.
  4. Install 5/8 inch bushed wall plates on telephone outlets.
  5. Fasten wall plates with vandal resistant screws in patients' area. Deliver 10 screw keys to the facility.
- E. Weatherproof Covers: Install weatherproof covers on wiring devices in damp locations.
- F. Weatherproof While In Use Covers: Install weatherproof while in use covers on wiring devices in wet locations.
- G. Nameplates: Provide phenolic or embossed aluminum nameplate for each special purpose receptacle indicating phase, ampere and voltage rating of the circuit. Attach nameplate with rivets or tamperproof fasteners to wall plate or to wall above receptacle. Wall plates may be engraved with required data in lieu of separate nameplates.
- H. Mats: Where flush plates are required over outlet boxes that cannot be set deep enough for the plates to fit closely over the finished wall surfaces, provide oak mats to fill the space between the finished wall surface and the plate.
- I. Receptacles On Emergency Circuits: Install red colored receptacles. Engrave faceplates "EMERGENCY" in 3/16 inch high lettering and fill engraving with contrasting color filler material.
- A. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
  5. Alternatively, if installed before wall repair or painting; provide protective covers for the devices. Replace any devices that have mortar, wallboard compound or are painted on visible or operative surfaces.



6. Openings or cuts around boxes, in wallboard or block walls, shall not exceed 1/8 inch. Coordinate repair of wall surface to match surrounding to comply with this requirement.
- B. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- C. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
1. Install ground pin GFCI receptacles so that wording is oriented for normal reading. Install ground pin of vertically mounted standard receptacles to match the orientation of GFCI receptacles.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. No opening in the wall shall be visible around the plate.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
  - 1. Receptacles: Identify panelboard and circuit number from which served. Write on inside of device plate with indelible marker and use durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 262726

## SECTION 262812 – SAFETY SWITCHES

### PART 1 - GENERAL

#### 1.01 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions.

### PART 2 - PRODUCTS

#### 2.01 SAFETY SWITCHES (SINGLE THROW)

- A. NEMA 1, 3R, 4 (Stainless Steel), 12: Eaton/ Cutler-Hammer Inc.'s Heavy Duty Series, General Electric Co.'s Heavy Duty Series, Siemens Inc.'s Heavy Duty Series, Square D Co.'s Heavy Duty Series, or approved equal; having:
  - 1. Fuses, or unfused as indicated on drawings.
  - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 262813 (UL Class RK-1, RK-5, L).
  - 3. NEMA 1 enclosure unless otherwise indicated on drawing.
  - 4. 240V rating for 120V, 208V, or 240V, circuits.
  - 5. 600V rating for 277V, or 480V circuits.
  - 6. Solid neutral bus when neutral conductor is included with circuit.
  - 7. Ground bus when equipment grounding conductor is included with circuit.
  - 8. Current rating and number of poles as indicated on drawings.
- B. NEMA 4X: Crouse-Hinds Co.'s NST, Square D Co.'s Heavy Duty Special Application Safety Switches, or approved equal; having:
  - 1. Fuses, or unfused as indicated on drawings.
  - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 262813 (UL Class RK-1, RK-5, L).
  - 3. Molded fiberglass-reinforced polyester NEMA 4X enclosure.
  - 4. 240V rating for 120V, 208V, or 240V, circuits.
  - 5. 600V rating for 277V, or 480V circuits.
  - 6. Solid neutral bus when neutral conductor is included with circuit.
  - 7. Ground bus when equipment grounding conductor is included with circuit.
  - 8. Current rating and number of poles as indicated on drawings.

#### 2.02 NAMEPLATES

- A. General: Precision engrave letters and numbers with uniform margins, character size minimum 3/16 inch high.
  - 1. Phenolic: Two color laminated engravers stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  - 2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  - 3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install switches so that the maximum height above the floor to the center of the operating handle does not exceed 6'-6".
- B. Identify each safety switch, indicating purpose or load served:
  - 1. NEMA 1 Enclosures: Rivet or bolt nameplate to the cover.
  - 2. NEMA 12 Enclosures: Rivet or bolt and gasket nameplate to the cover.
  - 3. NEMA 3R, 4, 4X Enclosures: Attach nameplate to the cover using adhesive specifically designed for the purpose, or mount nameplate on wall or other conspicuous location adjacent to switch. Do not penetrate enclosure with fasteners.
- C. Paint switches used for the fire protective signaling system with red paint and identify - "FIRE ALARM CIRCUIT CONTROL".
- D. Paint switches used for oil burner emergency switch with red paint and identify "OIL BURNER".

END OF SECTION 262812

## SECTION 262813 – FUSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less.

#### 1.2 SUBMITTALS

- A. Product Data: For each fuse type indicated.
- B. Operation and maintenance data.

#### 1.3 MAINTENANCE

- A. Spare Parts:
  - 1. Six spare fuses of each size and category, including any accessories required for a complete installation.
  - 2. Special tools if required for installation or removal of fuses.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussman, Inc.
  - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.
  - 5. Or Approved Equal.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage

## 2.3 FUSE HOLDERS

- A. Equipment provided shall be furnished with fuse holders to accommodate the fuses specified.

## 2.4 FUSES RATED 600V OR LESS

- A. Fuses for Safety Switches (Motor, Lighting and Heating Circuits) and Service Disconnects:
  - 1. Cartridge Type (250 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A2D-R.
    - b. Cooper Industries Inc.'s/Bussman Div. Type LPN-RK-SP.
    - c. Littlefuse Inc.'s Type LLNRK.
    - d. Or approved equal
  - 2. Cartridge Type (600 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A6D-R.
    - b. Cooper Industries Inc.'s/Bussmann Div. Type LPS-RK-SPI.
    - c. Littlefuse Inc.'s Type LLSRK-ID.
    - d. Or approved equal
  - 3. Cartridge Type (600 Volts or Less - Above 600 Amperes): Current limiting, UL Class L, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A4BQ.
    - b. Cooper Industries Inc.'s/Bussmann Div. Type KRP-C.
    - c. Littlefuse Inc.'s Type KLPC.
    - d. Or approved equal

## PART 3 - EXECUTION

### 3.1 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay 6r J, time delay.
- B. Feeders: Class L, time delay 6r J, time delay.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. Other Branch Circuits: Class RK5, time delay 6r J, time delay.

### 3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.3 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813





## SECTION 262815 – ELEVATOR POWER MODULE SWITCH

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Work of this section shall conform to the requirements of the Contract Documents.

#### 1.02 SECTION INCLUDES

- A. Provide Elevator Power Module Switch, fuses and accessories as required and specified on Contract Drawings to distribute electrical power to all Elevators.

#### 1.03 RELATED SYSTEMS

- A. Division 28 - Fire Alarm System
- B. Division 14 - Elevators
- C. Division 26 - Electricals

#### 1.04 CODES

- A. All work shall be performed in accordance with the latest edition of applicable standards, codes and laws.
  - 1. NFPA 70
  - 2. ANSI/ASME A17.1
  - 3. IBC
  - 4. NFPA 72

#### 1.05 STANDARDS

- A. Except as modified by governing codes, all equipment shall be manufactured in accordance with the latest applicable standards:
  - 1. Enclosed Switches, UL 98

#### 1.06 COORDINATION

- A. Submit drawings showing the location of electrical equipment supplied as part of this specification section that requires work space clearance in accordance with NFPA 70 Article 110 Part II. Work space clearance, including height, shall be indicated on the drawing, indicating where other trades are restricted from locating equipment, ductwork or piping. Locations for equipment furnished under this section may be shown on consolidated drawings submitted under Specification Section 16050. These drawings will be coordinated with the other trades by the General Contractor. Any changes to these drawings during the course of the construction shall be coordinated with all trades through the General Contractor prior to installing the equipment. Changes required by other trades as a result of lack of coordination through the General Contractor shall be borne by the Electrical Contractor.

#### 1.07 SUBSTITUTIONS

- A. Substitutions shall comply with the requirements of the General Conditions and General Requirements. The names of manufacturers and model numbers have been used to establish types

of equipment and standards of quality. A submittal shall contain sufficient information to prove compliance with Contract Documents. This includes compliance with all pertinent sections of codes and standards as specified above.

#### 1.08 SUBMITTALS

- A. Submit shop drawings and product data under the provisions of the General Conditions.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, configurations, and methods of mounting and installation.
- C. Submit listing of all types, sizes and quantity of fuses which will be installed including the location of each.
- D. Spare fuses shall be supplied as required by Section 16491.
- E. Coordination drawings

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Bussmann — Power Module Switch
- B. Approved equal

#### 2.02 GENERAL CONDITIONS & REQUIREMENTS

- A. Provide Power Module Switch in a single NEMA enclosure with all necessary relay(s), control transformer and other options (as listed below), and as shown on drawings. The Power Module Switch shall be constructed, listed, and certified to the standards as listed in above. The Power Module Switch shall have an ampere rating as shown on the Contract Drawings, and shall include a horsepower rated fusible switch or circuit breaker with shunt trip capabilities. The ampere rating shall be based upon elevator manufacturer requirements. Switches shall utilize Class J Fuses. It shall include as an accessory, a 100 VA control power transformer with primary and secondary fuses. The primary voltage rating shall be **408** volts with a 120 volt secondary. It shall also contain an isolation relay (3PDT, 10 amp, 120V). The coil of the isolation relay shall be 120V AC. A normally open dry contact shall be provided by the Fire Alarm Safety System to energize the isolation relay and activate the shunt trip solenoid.
- B. The module shall contain the following options:
- C. Key to Test Switch
- D. Green "On" Pilot Light
- E. Isolated Full Capacity Neutral Lug
- F. 1P Form C Mechanically Interlocked auxiliary contacts
- G. Fire Alarm Voltage Monitoring Relay
- H. NEMA 1 Enclosure

- I. The module shall have been successfully tested to a short circuit rating at 100,000 amps RMS Symmetrical. All switches shall shunt trip upon 120V AC signal from remote fire alarm signal. Branch feeders shall be selectively coordinated and fed with an upstream supply overcurrent protective device at a minimum of 2:1 size ratio utilizing Low-Peak (Class J, RK1, or L) fuses.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. All material installation shall be in accordance with manufacturer's recommendations and the provisions of applicable codes.
- B. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION 262815



## SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.

## 1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Submit drawings showing the location of electrical equipment supplied as part of this specification section that requires work space clearance in accordance with NFPA 70 Article 110 Part II. Work space clearance, including height, shall be indicated on the drawing, indicating where other trades are restricted from locating equipment, ductwork or piping. Locations for equipment furnished under this section may be shown on consolidated drawings submitted under Division 26 Section "BASIC ELECTRICAL REQUIREMENTS." These drawings

shall be coordinated with the other trades through the General Contractor. Any changes to these drawings during the course of the construction shall be coordinated with all trades through the General Contractor prior to installing the equipment. Changes required by other trades as a result of lack of coordination through the General Contractor shall be borne by the Electrical Contractor.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Specific fuse types noted on the drawings shall override general requirements of Division 26 section "FUSES."
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 4. Service-Rated Switches: Labeled for use as service equipment.

### 2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
  2. Ferraz Shawmut, Inc.
  3. Littelfuse, Inc.
  4. Or Approved Equal.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
1. Oiltight key switch for key-to-test function.
  2. Oiltight green ON pilot light.
  3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  4. Form C alarm contacts that change state when switch is tripped.
  5. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
  6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.



5. Or Approved Equal.

- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- H. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- I. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered or remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

## 2.5 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
1. Standard frame sizes and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

## 2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 3R.
  3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
  4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 262816

## SECTION 265100 – LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Interior luminaires.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Luminaires supports.

- B. Related Sections:

- 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature
- C. CRI: Color-rendering index.
- D. CU: Coefficient of utilization
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Driver and diodes factor.
  - 4. Energy-efficiency data.

5. Life, output, CCT, CRI, lumens and energy-efficiency data for luminaires.
  6. Photometric data, in IESNA format, based on laboratory tests of each luminaire type, outfitted with accessories identical to those indicated for the luminaires as applied in this Project. Provide conversion factors for all luminaire data if not the same as supplied for this project.
- B. Shop Drawings: For nonstandard or custom luminaires. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s), drawn to scale, on which luminaires, suspension system, construction that penetrates ceilings or is supported by them and other details are shown. Coordinate the following items, as a minimum, with each other, using input from Installers of the items involved:
1. Lighting fixtures.
  2. Suspended ceiling components.
  3. Structural members to which suspension systems for lighting fixtures will be attached.
  4. Other items in finished ceiling including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Smoke and fire detectors.
    - e. Occupancy sensors.
    - f. Access panels.
    - g. Ceiling mounted projectors
    - h. Partitions and millwork that penetrate the ceiling or extends to within one foot of the plane of the luminaires.
  5. Perimeter moldings.
- D. Product Certificates: For each type of ballast for dimmer-controlled fixtures, from manufacturer.
- E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- H. Warranties: Sample of special warranties.

## 1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Provide specified manufacturer or approved substitute manufacturer listed in Fixture Schedule.

## 1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies. Coordinate the following items, as a minimum, with each other, using input from Installers of the items involved:
  - 1. Lighting fixtures.
  - 2. Suspended ceiling components.
  - 3. Structural members to which suspension systems for lighting fixtures will be attached.
  - 4. Other items in finished ceiling including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Smoke and fire detectors.
    - e. Occupancy sensors.
    - f. Access panels.
    - g. Ceiling mounted projectors
    - h. Partitions and millwork that penetrate the ceiling or extends to within one foot of the plane of the luminaires.

## 1.7 WARRANTY

- A. Special Warranty for Emergency Luminaires Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
  - 2. Completion.
- B. Special Warranty for LED: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: Ten year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In the Luminaire Schedule where titles below are column or row headings that introduce lists or are added in notes for particular luminaire types, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  2. Basis-of-Design Product: The design for each luminaire is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by another manufacturer equal to the specified. Provide manufacturers data sheets and point-to-point calculations for the substituted luminaires.

### 2.2 LUMINAIRES,, GENERAL REQUIREMENTS

- A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
1. Aluminum or steel housing; finish.as per luminaire schedule on plans
- B. LED Luminaires: Comply with UL 1598. .
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.
- F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
  4. Laminated Silver Metallized Film: 90 percent.
- G. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
    - b. UV stabilized.
  2. Glass: Annealed crystal glass, unless otherwise indicated.



## 2.3 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

## 2.4 EMERGENCY LED BATTERY UNITS

- A. Description: Self-contained units complying with UL 924.
  - 1. Battery: Sealed, maintenance-free, lead-acid type.
  - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 6. Integral Time-Delay Relay: Holds unit on for fixed interval of 10 minutes when power is restored after an outage.
  - 7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

## PART 3 - PRODUCTS

### 3.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

### 3.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI of minimum 80 ; CCT of 3500 K
- D. Rated lamp life of minimum **50,000** hours.
- E. LED dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage – see Luminaire Schedule on plans.
- H. Housings:

## PART 4 - EXECUTION

### 4.1 INSTALLATION

- A. Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Luminaires in or on Grid-Type Suspended Ceilings: Use grid as a support element.
  - 1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 3. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wires or rods shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Luminaires Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

- 3. Do not use grid as support for pendant luminaires. Provide support wires or rods connected to building structure.
- D. Adjust aimable luminaires to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### 4.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100



## SECTION 265119 – LED INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.

#### 1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.

- D. Sample warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Minimum Ten year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 80 ; CCT of 3500 K
- F. Rated lamp life of minimum **50,000** hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage – see Luminaire Schedule on plans.
- J. Housings:
  - 1. Aluminum or steel housing; finish.as per luminaire schedule on plans

## 2.3 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Division 26 for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, as per manufacturer's specifications.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Aircraft cable shall be 1/8 inch.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with two minimum 5/32-inch diameter aircraft cable supports adjustable to 36 inches.
- H. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **wire support** for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

- I. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119



## SECTION 265600 – EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that use LED technology.
2. Luminaire-mounted photoelectric relays.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: Lithonia WST LED or approved equal.

2.2 GENERAL DESCRIPTION: A die-cast LED trapezoidal wall sconce with a non-pixelated light source for visual comfort. The lumen output of up to 6,500 lumens and an efficacy greater than 120 LPW. When required by Code, the luminaire must be available with two individual drivers paired with two independent light engines which provide the required redundancy.

- A. Construction: The single-piece die-cast aluminum housing integrates secondary heat sinks to optimize thermal transfer from the internal light engine heat sinks and promote long life. The driver is mounted in direct contact with the casting for a low operating temperature and long life. The die-cast door frame is fully gasket with a one-piece solid silicone gasket to keep out moisture and dust, providing an IP65 rating for the luminaire.
- B. Finish: Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can

withstand extreme climate changes without cracking or peeling. Standard Super Durable colors include dark bronze, black, natural aluminum, sandstone, and white. Available in textured and non-textured finishes.

- C. Optics: Well-crafted reflector optics allow the light engine to be recessed within the luminaire, providing visual comfort, superior distribution, uniformity, and spacing in wall-mount applications.
- D. Electrical: Light engine(s) consist of 98 high-efficacy LEDs mounted to a metal core circuit board and integrated aluminum heat sinks to maximize heat dissipation and promote long life (100,000 hrs at 40°C, L87). Class 2 electronic driver has a power factor >90%, THD <20%. Easily serviceable surge protection device meets a minimum Category B (per ANSI/IEEE C62.41.2).
- E. Installation: A universal mounting plate with integral mounting support arms allows the fixture to hinge down for easy access while making wiring connections.
- F. Listings: CSA certified to U.S. and Canadian standards. The luminaire is IP65 rated. PIR and back box options are rated for wet location. Rated for -30°C to 40°C ambient. DesignLights Consortium® (DLC) Premium qualified product. Not all versions of this product may be DLC Premium qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.
- G. Warranty: 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/CustomerResources/Terms\\_and\\_conditions.aspx](http://www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx).

## 2.01 LED FIXTURES

- A. LED Light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
- B. LED Light fixtures shall be Reduction of Hazardous Substances (RoHS) – compliant.
- C. LED Drives shall include the following features unless otherwise indicated.
  - 1. Minimum efficiency: 85% at full load
  - 2. Minimum Operating Ambient Temperature: -20 degrees C. (14 degrees F.)
  - 3. Input Voltage: 120 – 277V (+/-10%) at 60 Hz.
  - 4. Integral short circuit, open circuit, and overload protection.
  - 5. Power Factor: less than or equal to 0.95.
  - 6. Total Harmonic Distortion: less than or equal to 20%.
  - 7. Comply with FCC 47 CFR Part 15.

Fixtures: For fixture types see Lighting Fixture Schedule on drawings.

## 2.3 NOTES

- A. Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.
- B. Sample Nomenclature:
1. Standard: WST LED P1 40K VF MVOLT DDBTXD.
  2. With Redundant Gear: WST LED P1 40K VF MVOLT **DS** DDBTXD.
- C. Key Specifications:

Construction	Die-cast aluminum
Finish	zinc-infused Super Durable TGIC thermoset powder coat
Ingress Protection	IP65
Optics	Non-pixilated source, prismatic glass
Optical Performance	0% up-light and less than 20% back-light
Efficacy	>120 LPW
Lumen Maintenance	>L92 / 50,000 hours
CCT / CRI	2700K, 3000K, 4000K, 5000K; >70 CRI
Controls	Bi-level motion sensor

## PART 3 - EXECUTION

### 3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicate structural supports.
1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

### 3.2 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3.

### 3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

3.01 INSTALL ON CONCRETE BASE WITH TOP 4 INCHES ABOVE FINISHED GRADE OR SURFACE AT LUMINAIRE LOCATION. CAST CONDUIT INTO BASE, AND FINISH BY TROWELING AND RUBBING SMOOTH. CONCRETE MATERIALS, INSTALLATION, AND FINISHING ARE SPECIFIED IN DIVISION 3.

### 3.02 FIELD QUALITY CONTROL

- A. Inspect installed units for damage.
- B. Provide advance notice of dates and times for field tests. Coordinate with Architect.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include the following:
  - 1. Photometric Tests: Measure light intensities at locations where specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards.
  - 2. Check for excessively noisy ballasts.
  - 3. Check for uniformity of illuminations.
  - 4. Written report of tests indicating actual illumination results.
- E. Replace or repair damaged and malfunctioning units and retest.

### 3.03 ADJUSTING AND CLEANING

- A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

### 3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26. In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.5 GROUNDING

- A. Ground metal support structures according to Division 26.
- B. Ground nonmetallic support structures according to Division 26.

END OF SECTION 265600

## SECTION 270000 – COMMUNICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY OF WORK

- A. The scope of work specified by these documents shall result in the provision, installation and testing of the following IT Communications infrastructure, systems and equipment.
  - 1. All Voice and Data System Wiring
  - 2. Video/CATV Control and Distribution Systems
  - 3. Wiring for the ceiling mounted projectors
  - 4. Projectors and Projector Ceiling Mounts
  - 7. Paging/Intercom System (including wiring)
  - 8. Clock System (including wiring)
  - 8. Audio equipment and speakers in classrooms, Gymnasium, Cafeteria and other spaces of the building
  - 9. Security Access and Surveillance/CCTV Cameras (including wiring)
  - 10. Intrusion Alarm/Detection System (including wiring)
  - 11. Conduit and raceways. Cable ladders in MDF and IDFs shall be provided by Electrical Contractor
  - 12. Cabling and Terminations for Wireless Data Communication System (Wireless Access Points, WAPs, furnished by others)
- B. Systems shall utilize digital technology to integrate the following systems into a single network linking them to a central site:
  - 1. LAN System (Refer to Drawings IT-101and IT-102)
    - a. For data communications, the existing Wide Area Network will be the central means of communicating throughout for Authority-wide email, network access to shared files and Internet Access.
    - b. Locally, the facility will be provided with wiring for a Local Area Network for all local voice/data and video connectivity.
    - c. Data Network Backbone shall be comprised of 50/125-micrometer, optical fiber cabling.
    - d. Voice Backbone shall be 100 Pair Category 3 UTP cable.
  - 2. Wireless Data Communication System consisting of Category 6 horizontal cabling infrastructure.
    - a. Wireless Data Communications Network infrastructure shall be provided as per the specifications herein. Wireless Access Points (WAPs) shall be furnished by others. WAP symbols on drawings indicate termination points where WAPs are to be installed.
    - b. Topology
      - 1) The Wireless Data Communications Network specified herein will use a star Topology.

- 2) The network in which this system shall be integrated will consist of a Main Distribution Frame (MDF) and several Intermediate Distribution Frames (IDF's) connected to the MDF via two (2) 1GB EtherChannel fiber connections. The MDF contains the network servers and the network core. All IDF's will terminate horizontal workstation runs. The runs will connect to 10/100/1000 Ethernet switches (Furnished By Others) that are connected to the multi-mode fiber backbone that feeds the core switch that shall service both wired and wireless data networks.
- 3) The network backbone shall consist of gigabit Ethernet over multi-mode fiber.
- 4) The horizontal cabling to the desktop from the wiring closets shall consist of Fast Ethernet 100BASE-TX
- 5) Refer to Division 27 for detailed cabling requirements:
- c. This section includes the minimum requirements for termination hardware and cable for a Wireless Data Communication System.
- d. Quality Assurance
  - 1) All equipment shall be installed in a neat and workmanlike manner.
  - 2) All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Authority's representative.
  - 3) Materials shall be of the quality and manufacturer indicated. Only equipment and materials manufactured by major manufacturing companies are acceptable. No generic equipment or materials shall be allowed, unless otherwise approved in writing by the Design Consultant.
  - 4) Separation from sources of EMI shall be as specified in section.
  - 5) Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
  - 6) Materials and work specified herein shall comply with the applicable requirements of:
    - a) EIA/TIA-568-A.
    - b) EIA/TIA-569-A
    - c) EIA/TIA-606
    - d) EIA/TIA-607
    - e) Underwriters Laboratory
    - f) FCC (including CFR 47 and Part 68 - subpart F)
    - g) National Electric Code
    - h) Local and State Codes
    - i) ISO/IEC 11801
    - j) IEC 1000-5-2
    - k) CSA C22.2
    - l) IEC 60603-7
3. Video Control and Distribution System
  - a. Each designated room in the school will have a CATV outlet connected via the data network to the MDF/IDF, one (1) speaker that is connected to the amplifier serving the ceiling mounted projector outlet, and paging speakers that will be operated through the paging system.
  - b. The CATV / video system will allow teacher initiated playing of instructional DVDs and CDs as well as provide the capability to originate a video program material.
4. Audio - Video Systems

- a. Designated rooms (refer to IT-Drawings) shall be equipped with Local Sound Enhancement Systems that will have the capability to interface with a CD/DVD, MP3, WMA and LCD Projectors.
  - b. Audio/Video System shall be provided in designated locations that will allow for presentations, recording of performances and assemblies which require either PC based presentations or films and ADA compliant systems that shall provide assistance to the hearing impaired. The systems shall support both wired and wireless microphones. The Systems shall be provided in the following locations:
    - 1) Pre-K Gross Area
    - 2) OT/PT
    - 3) Cafeteria/Stage/Instrumental Music Room
- 5. Intra-Building Communications
  - a. Intra-Building communications will be done through a Paging/Intercom System.
    - 1) Each designated room (refer to IT-Drawings) in the school will have paging speakers one (1) of which will be operated through the paging system.
  - b. Clock and Paging System
    - 1) The Clock and Paging System in the school will be locally managed and controlled by the local administration. However, in the event or need for access into any one of the facilities, the WAN systems must be able to interoperate so that a paging call from the Board Offices or other pre- identified location, can page to all locations or an individual school location across the network.
    - 2) The Clock, Paging and Telephone/Intercom systems will be interconnected so that control of the time and paging system is determined through the Telephone system.
- C. These systems shall be integrated by means of an in building Network of cables.
  - 1. Cable Infrastructure
    - a. All horizontal technology cabling for the new school will be integrated with the data network, telephone, intercom, and security systems, utilizing Category 6; Fiber Optic and coaxial cables.
  - 2. Backbone cabling for data shall utilize laser optimized Fiber Optics cable as specified.
  - 3. Cabling for data and telecommunications between the jack plate and either MDF or IDF shall be category 6 (minimum).
  - 4. Based on distance limitations from MDF/IDF's to the classroom, the cabling distance standard of 290' for data networks shall be adhered to.
  - 5. Backbone cabling for the telephone system shall be multi-pair category 6 UTP sufficient to extend all telephone jacks and shall be run from the MDF/IDF to the Telco DeMarc.
  - 6. All designated spaces will be wired extensions off the clock and paging system.
  - 7. All wiring will be in conduit.

## 1.2 REGULATIONS AND CODE COMPLIANCE

- A. All work and materials shall conform to and be installed, inspected and tested in accordance with the most current governing rules and regulations of federal, state and local governmental agencies.
- B. The following is a list of codes and standards that will apply to this project:

1. New Jersey Uniform Fire Prevention and Building Code.
2. New Jersey Department of Labor Rules and Regulations.
3. New Jersey Department of Health.
4. Federal Occupational Safety and Health Administration - OSHA.
5. National Life Safety Code, NFPA 101.
6. National Electrical Code (NEC), NFPA 70
7. Underwriters Laboratory (UL).
8. ANSI/TIA/EIA - Telecommunications Building Wiring Standards (Most current addition, revision and addenda), including, but limited to, the following compilation series of documents: 568, 570, 598, 606, 607, 758, TSB 67, TSB 72, TSB 75, FIP 174, FIP175, FIP176,
9. BICSI Telecommunications Distribution Methods Manual, Telecommunications Cabling Installation Manual, Customer-Owned Outside Plant Manual, LAN and Internetworking Design Manual.
10. IEEE Standards.
11. IEEE-SA - National Electrical Safety Code (NESC)
12. Federal Communications Commission.
13. NEMA – National Electrical Manufacturers' Association
14. CSA – Canadian Standards Association
15. ADA, Americans with Disabilities Act.

### 1.3 GLOSSARY

- A. ANSI: American National Standards Institute
- B. ASME: American Society of Mechanical Engineers
- C. ASTM: American Society for Testing Materials
- D. BICSI: Building Industry Consulting Services International
- E. CSA: Canadian Standards Association
- F. EIA: Electronic Industries Association
- G. FCC: Federal Communications Commission
- H. FM: Factory Mutual Insurance Company
- I. IEEE: Institute of Electrical and Electronics Engineers
- J. IRI: Industrial Risk Insurers
- K. ISO: International Standards Organization
- L. NEC: National Electrical Code
- M. NEMA: National Electrical Manufacturers' Association
- N. NESC: National Electrical Safety Code
- O. NFPA: National Fire Protection Association
- P. New Jersey BFU: New Jersey Board of Fire Underwriters



- Q. New Jersey /DEC: New Jersey Department of Environmental Conservation
  - R. New Jersey /UFBC: New Jersey Uniform Fire Prevention and Building Code
  - S. OSHA: Occupational Safety and Health Administration
  - T. TIA: Telecommunications Industry Association
  - U. UFPO: Underground Facilities Protective Organization
  - V. UL: Underwriter's Laboratories, Inc.
- 1.4 DEFINITIONS
- A. Approved / Approval: Written permission to use a material or system.
  - B. As Called For: Materials, equipment including the execution specified/shown in the contract documents.
  - C. Code Requirements: Minimum requirements.
  - D. Concealed: Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
  - E. Design Equipment: Refer to the article, BASIS OF DESIGN.
  - F. Design Make: Refer to the Article, BASIS OF DESIGN.
  - G. Equal or Equivalent: Equally acceptable as determined by Design Consultant.
  - H. Exposed: Work not identified as concealed.
  - I. Final Acceptance: The Authority's acceptance of the project from Contractor upon certified by the Authority's Representative.
  - J. Furnish: Supply and deliver to installation location.
  - K. Furnished by Others: Receive delivery at job site or where called for and installed.
  - L. Inspection: Visual observations by the Authority's site Representative.
  - M. Install: Mount and connect equipment and associated materials ready for use.
  - N. Labeled: Refers to classification by a standards agency.

- O. Make: Refer to the article, BASIS OF DESIGN.
- P. Or Approved Equal: Approved equal or equivalent as determined by Design Consultant.
- Q. Authority's Representative: The Prime Professional
- R. Prime Professional: Design Consultant having a contract directly with the Authority for professional services.
- S. Provide: Furnish, install and connect ready for use.
- T. Relocate: Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
- U. Replace: Remove and provide new item.
- V. Review: A general contractual conformance check of specified products.
- W. Roughing: Pipe, duct, conduit, cabling, equipment layout and installation.
- X. Satisfactory: As specified in contract documents.
- Y. Site Representative: Construction Manager at the work site.
- Z. Refer to General Conditions of the Contract for additional definitions.

#### 1.5 INTENT OF DRAWINGS

- A. The drawings are diagrammatic, unless detailed dimensioned drawings are included. Drawings show approximate locations of equipment, and fixtures. Exact locations are subject to the approval of the Authority's Representative.
- B. The Contractor should verify all dimensions locating the work and its relation to existing work, all existing conditions and their relation to the work and all man made obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the Contract Documents.

### PART 2 – PRODUCTS

#### 2.1 Equipment and Materials Minimum requirements:

- A. Materials requirements:
  - 1. All equipment and material for which there is a listing service shall bear a UL label.
  - 2. Electrical equipment and systems shall meet UL Standards and requirements of the NEC and CSA. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
  - 3. Equipment shall meet all applicable FCC Regulations
  - 4. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

5. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the Specifications and meet the quality of the design make.
6. Where applicable, all materials and equipment shall bear the label and listing of Underwriters Laboratory of Factory Mutual. Application and installation of all equipment and materials shall be in accordance with such labeling and listing.

B. Proprietary Specifications:

1. The following product/manufacturer has been approved by the Authority for proprietary specifications and use in this project.
  - a. Wireless Access Points: Meru
2. Subject to compliance with codes and all project requirements, the Contractor is required to use the indicated product/manufacturer and to verify compatibility with the project School District's existing systems.

C. Proprietary Specifications:

1. The following product/manufacturer has been approved by the Authority for proprietary specifications and use in this project.
  - a. Call Manager: Cisco Unity
2. Subject to compliance with codes and all project requirements, the Contractor is required to use the indicated product/manufacturer and to verify compatibility with the project School District's existing systems.

D. Proprietary Specifications:

1. The following product/manufacturer has been approved by the Authority for proprietary specifications and use in this project.
  - a. WAN and Internet Service: Cablevision
2. Subject to compliance with codes and all project requirements, the Contractor is required to use the indicated product/manufacturer and to verify compatibility with the project School District's existing systems.

## 2.2 CABLES

- A. Any cable associated with this Contract, passing through two or more floors shall be suitable, listed and marked for use in a riser or plenum application. Riser cable shall minimally be CMR or OFNR rated per the National Electrical Code and shall meet all local and state codes.
- B. Any cable associated with this Contract shall be rated, listed and marked for use in a plenum application, regardless if the ceiling is a ducted return air plenum or not. Cable shall meet all local and state codes.
- C. Voice copper backbone cables, if required, shall be twisted 24 AWG, contain a corrugated aluminum shield, be of the size indicated on the drawings and have the proper jacket classification per the NEC.
- D. All copper underground feeder cable associated with this Contract, if required, shall be suitable, listed and marked for use in a duct application per the National Electrical Code article 800 and shall meet all local codes. Copper underground cables shall be jell-filled, twisted 24 AWG., contain a overall corrugated shield, be of the size indicated on the drawings, shall have footage indicators imprinted on the cable jacket and shall meet REA/RUS specification PE-39 or PE-89.

## 2.3 FACTORY ASSEMBLED PRODUCTS

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
  - 1. All components of an assembled unit need not be products of same manufacturer.
  - 2. Constituent parts, which are alike, shall be product of a single manufacturer.
  - 3. Components shall be compatible with each other and with the total assembly for intended service.
- C. Components of equipment shall bear manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment that serve the same function must be the same make and model. Exception will be permitted if performance requirements cannot be met.

## 2.4 COMPATABILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.
- B. Provide maximum standardization of components to reduce spare part requirements.
- C. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
  - 1. All components of an assembled unit need not be products of same manufacturer.
  - 2. Constituent parts that are alike shall be product of a single manufacturer.
  - 3. Components of equipment shall bear manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

## 2.5 LIFTING ATTACHMENTS

- A. Equipment should have suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered without bending or distortion of shape, such as rapid lowering and braking of load.

## 2.6 MISCELLANEOUS SUPPORTS

- A. Metal bars, plates, tubing, etc. shall conform to the following ASTM standards:
  - 1. Steel plates, shapes, bars, and grating - ASTM A 36
  - 2. Cold-Formed Steel Tubing - ASTM A 500
  - 3. Hot - Rolled Steel Tubing - ASTM A 500
  - 4. Steel Pipe - ASTM A 53, Schedule 40, welded
- B. Metal Fasteners shall be Zinc-coated (type, grade and class as required)

## 2.7 FIRESTOPPING

- A. Firestopping for Openings through Fire and Smoke Rated Walls and Floor Assemblies shall be listed or classified by an approved independent testing laboratory for "Through-Penetration Firestop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetration Firestops" designated ASTM E814.
- B. Inside of all conduits, the firestop system shall consist of a dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required). The sealant must be capable of being removed and reinstalled and must adhere to all penetrants and common construction materials and shall be capable of allowing normal wire/cable movement without being displaced.
- C. All conduit and sleeve openings shall be waterproofed or fireproofed in compliance with New Jersey Building and Fire Codes. Strict adherence to National and State Fire Codes, particularly firestopping will be required.
- D. All openings remaining around and inside all conduit, sleeves and cable penetrations to maintain the integrity of any fire rated wall, ceiling, floor, etc. shall be patched.
- E. All building conduits and sleeves installed and/or used under this contract shall be firestopped or re-firestopped upon cable placement through such passageways.
- F. Manufacturer's recommended installation standards must be closely followed (i.e. minimum depth of material, use of ceramic fiber and installation procedures).
- G. Provide firestop system seals at all locations where conduit, fiber, cable trays, cables/wires, and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide firestop seal between sleeve and wall for drywall construction.
- H. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the firestop system. The installation shall provide an air and watertight seal.
- I. The methods used shall incorporate qualities that permit the easy removal or addition of conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating. Typical rating:
  - 1. Floors - 3 hours
  - 2. Corridor walls - 2 hours
  - 3. Offices -  $\frac{3}{4}$  hour
  - 4. Smoke partitions -  $\frac{3}{4}$  - 1 hour
- J. Provide firestop pillows for existing cable tray penetrations through firewalls.

## PART 3 - EXECUTION

### 3.1 ROUGH-IN

- A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for installation with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the Authority's representative for approval before proceeding.
- B. All equipment locations shall be coordinated with other trades, other renovation projects, and existing conditions to eliminate interference with required clearances for equipment maintenance and inspection.
  - 1. Coordinate work with other trades, other renovation projects, and existing conditions to determine exact routing of all cable tray, hangers, conduit, etc., before fabrication and installation. Coordinate with Technology Drawings. Verify with the Authority's Representative exact location and mounting height of all equipment in finished areas, such as equipment racks, communication and electrical devices. Coordinate all work with existing architecture.
  - 2. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. There will be no priority schedule for trades. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Authority's Representative and approval received before such alterations are made.
- C. Provide easy, safe, and code mandated clearances at equipment racks and enclosures, and other equipment requiring maintenance and operation.

### 3.2 CUTTING AND PATCHING

- A. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch and/or paint openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

### 3.3 CONCEALMENT

- A. Use existing conduit and surface raceway where possible and practicable. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify the Authority's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after the Authority's Representative reviews and comments on arrangement and appearance.

### 3.4 CHASES

#### A. General

1. Field verifies for correct size and location for all openings, recesses and chase.
2. Assume responsibility for correct and final location and size of such openings.
3. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
4. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Cap or firestop all unused conduits and sleeves.
5. Provide angle iron frame where openings are required for contract work.
6. Seal voids in fire rated assemblies with a firestopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge-galvanized sleeves at fire rated assemblies. Extend sleeves 2" above floors.
7. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide firestopping seal between sleeves and wall in drywall construction. Provide firestopping similar to that for floor openings.

### 3.5 WATERPROOFING

- A. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.
- B. Spare conduits shall be plugged with expandable plugs.
- C. All service entrance conduits through building shall be sealed or resealed upon cable placement.
- D. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or waterproof duct seal.

### 3.6 SUPPORTS

- A. Provide required supports, beams, angles, hangers, rods, bases, braces, straps, struts, and other items to properly support contract work. Supports shall meet the approval of the the Authority's Representative. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above. For precast Panels/Planks and Metal Decks, support communication work as determined by manufacturer and the Authority's Representative. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

### 3.7 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- B. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
- C. Set all equipment to accurate line and grade, level all equipment and align all equipment

components.

- D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.
- E. No equipment shall be hidden or covered up prior to inspection by the Authority's representative. All work that is determined to be unsatisfactory shall be corrected immediately.
- F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

### 3.8 IMPLEMENTATION

- A. The contractor shall provide and install all hardware, software, connections and appurtenances required for fully operational systems.

END OF SECTION 270000



## SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Sleeves for pathways and cables.
2. Sleeve seals.
3. Grout.
4. Common communications installation requirements.

#### 1.2 SUBMITTALS

##### A. Product Data: For sleeve seals.

##### B. Warranty: Provide manufacturer's system warranty against electrical or mechanical defects for 2 years from date of final acceptance.

### PART 2 - PRODUCTS

#### 2.1 TELE-POWER POLES

##### A. Acceptable Manufacturers:

1. Mono-Systems, Inc.
2. Panduit Corp.
3. Wiremold/Legrand
4. Or approved equal

##### B. Material: Aluminum with clear anodized finish.

##### C. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

#### 2.2 SLEEVES FOR PATHWAYS AND CABLES

##### A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

##### B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

##### C. Sleeves for Rectangular Openings: Galvanized sheet steel.

##### 1. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

## 2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Acceptable Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or approved equal
  - 2. Sealing Elements: Interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
  - 3. Pressure Plates: Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Utilize 4" sleeves to provide clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7.
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7.

END OF SECTION 270500



## SECTION 270526 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, installation equipment, and test equipment required for the complete installation of grounding and bonding for telecommunications systems within the structure.

#### 1.2 REFERENCES

- A. ANSI-J-STD-607-A-2002 – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- B. National Fire Protection Association (NFPA – 70), National Electrical Code (NEC)
- C. ANSI T1.333-2001 – Grounding and Bonding of Telecommunications Equipment

#### 1.3 QUALITY ASSURANCE

- A. The materials and their installation shall conform to the requirements of ANSI-J-STD-607-A-2002 and the National Electrical Code
- B. Use adequate numbers of skilled work-persons thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

### PART 2 – PRODUCTS

#### 2.1 STANDARD

- A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by manufacturer and shall be labeled or listed by Underwriters Laboratories Inc. for use in electrical grounding.

#### 2.2 ACCEPTABLE MANUFACTURES

- 1. Harger Lightning & Grounding
- 2. Or Approved Equal

#### 2.3 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- A. The TMGB shall be ¼”T x 4”W x 12”L copper ground bar.
  - 1. The TMGB shall be predrilled with holes for use with standard sized lugs.
  - 2. The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A-2002
  - 3. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

## 2.4 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- A. The TGB shall be a ¼”T x 2”W x 12”L copper ground bar.
  - 1. The TMGB shall be predrilled with holes for use with standard sized lugs.
  - 2. The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A-2002.
  - 3. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

## 2.5 CONDUCTORS

- A. Conductors shall be stranded copper conductors with green insulation
  - 1. Minimum conductor size No. 6 AWG.
  - 2. Conductors shall be sized at 2 kcmil per linear foot of conductor length. For example: A conductor 25 feet in length shall be No. 2 AWG (66,360 cmil). A conductor 100 feet in length shall be No. 4/0 AWG (211,600 cmil)
  - 3. Insulation shall be rated for the environment where it is installed.

## 2.6 CONNECTOR LUGS

- A. Lugs for connecting to the TMGB and TGB shall be UL Listed two-hole, long barrel, electro tin-plated compression lugs with inspection port.
  - 1. Antioxidant joint compound shall be applied to the contact areas.
  - 2. Lugs shall be secured to the ground bars with ¼” minimum stainless steel hex head cap screws with stainless steel washers, lock washers and nuts.

## 2.7 EXOTHERMIC WELDED CONNECTIONS

- A. Exothermic Welded connections shall be.
  - 1. Weld types BE shall be made to the ground bars using appropriate size weld metal.
  - 2. Weld types VA, VD, or VU shall be made to structural steel framework

# PART 3 – EXECUTION

## 3.1 INSTALLATION

- A. The telecommunications main grounding bar (TMGB) is a dedicated extension of the building grounding electrode system for the telecommunications system. The TMGB should be located near the telecommunications service entrance and the electric service entrance.
  - 1. The TMGB shall be connected to the main electric service entrance panel ground or the branch electric panel ground that serves the telecommunications equipment.
  - 2. The TMGB shall be located to minimize the length of the bonding conductor for telecommunications from the TMGB to the electric service ground.
  - 3. The bonding conductor for telecommunications shall be at least the same size as the telecommunications backbone (TBB) conductor.
  - 4. The TMGB shall serve telecommunications equipment that is located in the same room or space.
  - 5. Connections to the TMGB shall be made by exothermic welding or by listed two-hole

- compression lugs.
  6. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.
    - a. Metal conduits 1" diameter and larger shall be bonded using electro tin-plated pipe clamps.
    - b. Metal conduits less than 1" diameter shall be bonded using electro tin-plated conduit bonding clamps.
    - c. Metal cable trays shall be bonded using electro tin-plated cable tray bonding clamps.
    - d. Bonding surface areas shall be cleaned to bare metal removing all paint, etc. The contact area shall be protected from corrosion using antioxidant joint compound.
  7. Where an electric power panel for telecommunications equipment is located in the same room or space as the TMGB, the panel ground bus or panel enclosure shall be bonded to the TMGB.
  8. The TMGB shall be located in an area that is accessible to telecommunications personnel
- B. The telecommunications backbone (TBB) is a conductor that originates at the TMGB and extends throughout the building interconnecting all telecommunications grounding busbars (TGBs) with the TMGB.
1. The TBB shall be a copper conductor. The minimum size of the conductor shall be No. 6 AWG. The size of the conductor shall be increased 2 kcmil per linear foot as the length of the TBB increases. For example: A TBB 25 feet in length shall be No. 2 AWG (66,360 cmil). A TBB 100 feet in length shall be No. 4/0 AWG (211,600 cmil)
  2. The TBB conductors should be installed without splices. Where splices are necessary, the number of splices should be minimized and located in accessible telecommunications spaces. Splices shall be made using exothermic welding, listed irreversible compression connectors or equivalent.
  3. The building water piping system shall not be used as a TBB.
  4. Metallic cable shields or metallic conduits shall not be used as a TBB.
- C. A telecommunications grounding busbar (TGB) shall be provided in each area where telecommunications equipment is located. The TGB is the grounding connection point for telecommunications systems and equipment in each separate area.
1. The TGBs shall be connected to the TMGB via the TBB conductor.
  2. The TBB and other TGBs within the same area shall be bonded to the TGB with a conductor the same size as the TBB.
  3. The bonding conductor between the TBB and the TGB shall be continuous and routed in the shortest straight-line path possible.
  4. Connections to the TGB shall be made by exothermic welding or by listed two-hole compression lugs.
  5. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.
  6. Where an electric power panel for telecommunications equipment is located in the same room or space as the TGB, the panel ground bus or panel enclosure shall be bonded to the TGB.

- D. Where there are multiple telecommunications rooms or spaces with multiple TBBs, the TBBs shall be interconnected with a Grounding Equalizer (GE) conductor at the TGBs.
  - 1. Welding.
  - 2. In structural steel frame buildings, where the steel framework is accessible The GE shall be sized as specified for the TBB.
- E. Connections of the GE to the TGBs shall be made by exothermic within the room; the TMGB and each TGB shall be bonded to the structural steel frame using a minimum No. 6 AWG conductor.
  - 1. Connections to the structural steel frame shall be made by exothermic welding. The area of contact on the steel frame shall be cleaned to bare metal removing all paint and mill scale. The contact area shall be protected from corrosion using antioxidant joint compound.
  - 2. Where the structural steel frame is external to the room and is accessible, the structural steel should be bonded to the TGB or the TMGB using a minimum No. 6 AWG conductor.

END OF SECTION 270526



## SECTION 270528 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SCOPE OF SPECIFICATION

- A. This section includes the minimum requirements for the following: EMT conduit J-Hooks Threaded Rod Cover Stackable Cable Rack Spacers Cable Management Wireless Access Boxes Fire Stopping Materials Floor Boxes.

#### 1.2 SUBMITTALS

- A. As-Built Drawings

#### 1.3 QUALITY ASSURANCE

- A. All installation work for the interior telecommunications pathways shall be performed in a neat and workmanlike manner.
- B. Equipment and materials shall be of the quality and manufactures indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified.
- C. Materials and work specified herein shall comply with the applicable requirements of:
  - 1. ANSI/NFPA 70 – National Electrical Code including; but not limited to, the following articles:
    - a. 250 – Grounding
    - b. 300 – Wiring Methods
    - c. 314 – Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Manholes
    - d. 358 – Electrical Metallic Tubing: Type EMT
    - e. 386 – Surface Metal Raceways
    - f. 770 – Optical Fiber Cables and Raceways
  - 2. ANSI/TIA/EIA-568-B.1 – Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements, including applicable addendum
  - 3. ANSI/TIA/EIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces, including applicable addendum
  - 4. ANSI/TIA/EA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
  - 5. ANSI/TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 6. BICSI Telecommunications Distribution Methods Manual

#### 1.4 FUNCTIONAL SYSTEM DESCRIPTION

- A. Refer to scaled Technology (T) drawings for lengths of cable runs.

### PART 2 - PRODUCTS

#### 2.1 EMT CONDUIT AND OUTLET BOXES

A. Electrical Metallic Tubing (EMT)

1. Electro-galvanized steel tubing 1 1/4" and larger diameter per project requirements: Conduit joint couplings and connectors: steel double set screw indenter fittings, metal bushings for 1 1/4" conduit, insulated metallic bushings for 1-1/4" and larger conduit, insulated metallic bushings with grounding lugs as required.
2. Conduit sweeps: minimum 10 times the conduit inside diameter.
3. Include required conduit straps, and hangers, heavy-duty malleable iron or steel, perforated pipe strap, j-hooks, bridle rings, or wire hangers are not permitted.
4. LB fittings and plastic fittings are not permitted
5. Nipple runs from one outlet box to another outlet box are not permitted.

B. Outlet boxes: Galvanized steel sheet metal 2" x 4" x 2-1/8" deep minimum with single gang mud ring, except for Teacher's Jack.

1. Teacher's Outlet boxes: This requires one (1) 4" x 4" gang boxes at each Teacher's Outlet location.

C. Pull-boxes: Minimum 14 gauge galvanized steel with screw fastened cover and trim for flush or surface mounting as required for the project. Dimensions as required for the project.

D. Metal Flex Conduit (1 1/4") and deep Cut-In Boxes where required.

E. Pull-rope: Polypropylene monofilament line with a minimum pull tensile strength of 200 pounds.

F. Labels for conduit and pull-boxes: 1" x 2" yellow background with 3/8" lettering to read "TELECOM"

## 2.2 NON-CONTINUOUS CABLE SUPPORT (J-HOOKS) SYSTEMS

A. Construction:

1. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
3. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
5. Stainless steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

B. Multi-Tiered Non-Continuous Cable Supports Assemblies:

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits.
2. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
3. If required, the multi-tier support bracket may be assembled to manufacturer

recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

C. Non-Continuous Cable Support Assemblies from Beam, Flange:

1. Fastener to C to Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

D. Non-Continuous Cable Support Assemblies from C & Z Purlin:

1. Fastener to C to Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.

E. Non-Continuous Cable Support Assemblies from Wall, Concrete, or Joist

1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.

F. Non-Continuous Cable Support Assemblies from Threaded Rod:

1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
2. The multi-tiered support bracket shall have a static load limit of 300 lbs.

G. Installation Accessories for Non-Continuous Cable Supports

1. Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included.
2. The pulley shall be made of plastic and be without sharp edges.
3. The pin and bail assembly must be able to be secured to the J-Hook during cable installation.
4. The pulley must remain secured while cables are being pulled.
5. The pin and roller assembly must be removed after cables are installed.

## 2.3 WIRELESS ACCESS BOXES

A. Wall-mounted enclosure for Wireless Access Equipment-Gymnasium

1. Vented Steel enclosure 11" x 8" x 3"
2. Finish matching wall plates
3. Continuous hinge swing door with keyed lock
4. Knockouts for cable entry/exit
5. Two 1" antenna openings 5" apart on top of enclosure
6. Include components and compatible fittings from the manufacturer as required for a complete installation

B. Ceiling Enclosure for Wireless Access Equipment – classrooms and hallways

1. Plenum-rated enclosure
2. Mounts in standard 2' x 2' or 2' x 4' ceiling tile
3. Continuous hinge swing down door with keyed lock
4. Cable entry/exit opening with approved fire-rating foam kits
5. Two 1" antenna openings 5" apart on bottom of enclosure
6. Include components and compatible fittings from the manufacturer as required for a

complete installation.

## 2.4 FLOOR BOXES

### A. Acceptable Manufacturers:

1. Legrand
2. Wiremold
3. Or Approved Equal

### B. Floor Boxes

1. Classification and Use: Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and/or UL514C and Canadian Standard C22.2, No. 18.1-04 and 18.2-06 and bear the U.S. and Canadian UL Listing Mark. Floor boxes shall also have been tested by Underwriters Laboratories Inc. and classified for fire resistance and bear the U.S. and Canadian UL Classification Mark. Devices shall be classified for use in 2-hour rated, unprotected reinforced concrete floors and 2-hour rated floors employing unprotected steel floor units and concrete toppings (D900 Series Designs) or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling below the floor boxes). Floor boxes shall also conform to the standards set in Section 300-21 of the National Electrical Code. Floor boxes shall meet UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens. Floor boxes shall also have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, bare concrete, terrazzo, wood, and carpet covered floors. Floor boxes shall be suitable for use in air handling spaces in accordance with Section 300-22 (C) of the National Electrical Code.
2. Floor Boxes, General: Evolution Series Floor Boxes for use on above grade concrete floors, raised floors or wood floors. Provide boxes with a component to permit installation in polished concrete or terrazzo floors. Boxes shall be compatible with complete line of workstation connectivity outlets and modular inserts.
  - a. Floor boxes provide the interface between power, communication and audio/video (A/V) cabling in above-grade floors, on-grade concrete floors, raised floors, wood floors, and fire-classified floors and the workstation or activation location where power and communication and/or A/V device outlets are required. Boxes shall provide recessed device outlets that will not obstruct the floor area. Refer to Drawings for size and types.
  - b. Floor boxes shall permit all wiring to be completed at floor level. The FC models shall be used as defined by the UL Fire Resistance Directory at a minimum spacing of two (2) ft [610mm] on center.

### C. The following model floor boxes shall be used according to the appropriate connector density and architectural application.

1. Model EFB6S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with provisions that enable

installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 6-15/16 in<sup>2</sup> [176mm<sup>2</sup>]. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

2. Model EFB6S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate.

Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp,

20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

3. Model EFB6S-FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire-rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services.

Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with four (4) intumescent services feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

4. Model EFB8S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 12-3/4" W x 6-1/16" H. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) receptacles, communication and/or audio/video services. Boxes shall accept standard size single gang (2-3/4" x 4-1/2"), double gang (4-9/16" x 4-1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 28-in<sup>3</sup>. Each of the four (4) center compartments shall have a minimum wiring capacity of 34-in<sup>3</sup>. Each of the eight (8) compartments shall have a minimum depth of 3- 1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 11-5/8 in<sup>2</sup>. The box shall contain the following number of knockouts: four (4) 3/4-inch trade size, eight (8) 1-inch trade size, six (6) 1-1/4-inch trade size, and two (2) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a



maximum 1/2" post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

5. **Model EFB8S-OG Floor Boxes:** Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 12-5/8" W x 6-1/16" H [385mm x 321mm x 154mm]. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 28-in3 [455ml]. Each of the four (4) center compartments shall have a minimum wiring capacity of 34-in3 [455ml]. Each of the eight (8) compartments shall have a minimum depth of 3- 1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 12 1-inch trade size, six (6) 1-1/4-inch trade size, and four (4) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept standard size single gang (2-3/4" x 4-1/2"), double gang (2-3/4" x 4- 1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers and other open system devices.
  
6. **Model EFB8S-FC Floor Boxes:** Manufactured from stamped steel approved for use in 2-hour fire- rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) receptacles, communication and/or audio/video services. Boxes shall have removable and repositionable dividers to permit feed to adjacent compartments and reconfiguration of devices. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the compartments shall have a minimum wiring capacity of 53-in3 [860ml]. Each of the eight (8) compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable compartments to facilitate installation. Provide boxes with four (4) intumescent services

feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept standard size single gang (2-3/4" x 4-1/2"), double gang (4-9/16" x 4-1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

7. Model EFB10S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 12-3/4" W x 6-1/16" H [385mm x 324mm x 154mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with 10 independent wiring compartments that allow for up to 10 receptacles, communication and/or audio/video services. Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Six (6) of the 10 compartments shall have a minimum wiring capacity of 23-1/2-in3 [597ml]. Four (4) of the 10 compartments shall have a minimum wiring capacity of 27-in3 [686ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 11-5/8 in2 [7500mm2]. The box shall contain the following number of knockouts: four (4) 3/4-inch trade size, 10 1-inch trade size, eight (8) 1-1/4-inch trade size, and two (2) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
8. Model EFB10S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 12-5/8" W x 6-1/16" H [385mm x 321mm x 154mm]. Provide boxes with 10 independent wiring compartments that allow for up to 10 duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a



tunnel. Six (6) of the 10 compartments shall have a minimum wiring capacity of 23-1/2-in<sup>3</sup> [597ml]. Four (4) of the 10 compartments shall have a minimum wiring capacity of 27-in<sup>3</sup> [686ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 14 1-inch trade size, six (6) 1-1/4-inch trade size, and four (4) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

9. Model EFB10FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire-rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with 10 independent wiring compartments that allow for up to 10 receptacles, communication and/or audio/video services. Boxes shall have removable and repositionable dividers to permit feed to adjacent compartments and reconfiguration of devices. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the compartments shall have a minimum wiring capacity of 53-in<sup>3</sup> [860ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with four (4) intumescent services feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
10. Model EFBFF Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (FP-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be 7-1/16" L x 6-5/8" W x 4-1/8" H [179mm x 168mm x 105mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with two (2) independent wiring compartments that allow for power, communication and/or audio/video services. Each of the two (2) wiring compartments shall have a minimum wiring capacity of 64- 1/2-in<sup>3</sup> [1056ml]. The box shall be equipped with a metal divider to separate the services and maintain code requirements. The box shall contain the following number of knockouts:

four (4) 1/2-inch trade size, four (4) 3/4"-inch trade size, one (1) 1-inch trade size, six (6) 1-1/4-inch trade size, one (1) 1-1/2-inch trade size, and two (2) 2-inch. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors.

11. Model EFBFF-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (FP- CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 7-1/16" L x 6-5/8" W x 4-1/8" H [179mm x 168mm x 105mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with two (2) independent wiring compartments that allow for power, communication and/or audio/video services. Each of the two (2) wiring compartments shall have a minimum wiring capacity of 64- 1/2-in<sup>3</sup> [1056ml]. The box shall be equipped with a metal divider to separate the services and maintain code requirements.

The box shall contain the following number of knockouts: four (4) 1/2-inch trade size, four (4) 3/4"-inch trade size, one (1) 1-inch trade size, six (6) 1-1/4-inch trade size, one (1) 1-1/2-inch trade size, and two (2) 2-inch. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment.

- D. Activation Covers: The following model covers shall be used according to the appropriate application.

1. Evolution EFB610BT and EFB610CT Series Covers: Manufactured of die-cast aluminum. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be available with a carpet recess area or a solid lid. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in<sup>2</sup> [102mm<sup>2</sup>], or a minimum of 8-in<sup>2</sup> [203mm<sup>2</sup>] per cover assembly. Cover finish shall be as follows:
2. FloorPort FPFFTC Series Covers: Manufactured of die-cast aluminum or die-cast zinc, and available in brushed aluminum finish and powder-coated paint finishes (black, gray, bronze, nickel and brass). Activation covers shall be available in flanged version. Covers shall come equipped with one (1) 1-inch trade size screw plug opening and one (1) combination 1-1/4-inch and 2-inch trade size screw plug.

- a. Flanged covers shall be 7-3/4" L x 6-9/16" W [197mm x 167mm].

## 2.5 FIRE STOPPING

- A. Fire Stopping materials used for this project shall comply with the following:

1. Products shall allow for normal expansion and contraction movement of the penetrating item without failure of the penetration seal.
2. Products shall emit no hazardous, combustible, or irritating by-products during installation or curing period.
3. Products shall not require special tools for installation.
4. Products shall provide penetration seal assemblies whose fire-resistance ratings have been determined by testing in the configurations required and which have fire-resistance ratings at least as high as that of the fire-rated assembly in which they are to be installed.
5. All fire stopping shall be manufactured by the following:
  - a. Bio Fireshield, Inc.
  - b. Dow Corning Corp.
  - c. GE Silicones, Hilti, Inc.
  - d. 3M Ceramic Materials.
  - e. Or Approved Equal

### PART 3 - EXECUTION

#### 3.1 PATHWAYS

- A. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations and shall have no exposed sharp edges that may come into contact with data or telecommunications cables.
- B. All wall penetrations shall be installed with sleeves that shall have no exposed sharp edges that may come into contact with data or telecommunications cables.
- C. Pathways shall not be located in elevator shafts unless specifically approved by the Design Consultant in writing.

#### 3.2 CABLE PATHWAYS

- A. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
- B. Cable pathways, which run parallel with electric power or lighting that is less than or approved equal to 480 Vrms, shall be installed with a minimum clearance of 6 in.
- C. In the MDF/IDF(s) where cable trays or cable racking are used, the appropriate means of cable management such as reusable color-coded hook and loop cable managers (ties) shall be used to create a neat appearance and practical installation.
- D. Continuous conduit runs installed by the contractor should not exceed 100 feet or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.
- E. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.

#### 3.3 FIRE PROTECTION

- A. All wall penetrations shall require properly installed firestop systems code compliant that shall be installed to prevent or retard the spread of fire, smoke, water, and gases through the building.

- B. Sheathing installed for wall penetrations must also be firestopped.
- C. Fire stops shall be done to applicable code using approved materials.

END OF SECTION 270528

## SECTION 270536 – CABLE TRAY FOR COMMUNICATIONS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes cable trays and accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 07 Section "Firestopping."

#### 1.03 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each component. Show tray types, dimensions, and finishes.
- C. Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plates connectors, expansion joint assemblies, straight lengths, and fittings.
- D. Coordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.
- E. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- F. Factory certified test reports of specified products, conforming to NEMA VE 1.
- G. Field test reports indicating and interpreting test results relative to compliance with performance requirements specified in "Field Quality Control" Article of this Section.
- H. Maintenance data for cable tray, for inclusion in "Operating and Maintenance Manual" specified in Division 1. Include detailed manufacturer's instructions on tightening connections.

#### 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays similar to those indicated for this Project and which has a record of successful in-service performance.
- B. Comply with NFPA 70, "National Electrical Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

- D. Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

#### 1.05 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable tray with other installations.
  1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cable trays that may be incorporated in the Work include, but are not limited to, the following:
  1. B-Line Systems, Inc.
  2. Chalfant Manufacturing Co.
  3. GS Metals Corp.
  4. Mono-Systems, Inc.
  5. P-W Industries, Inc.
  6. Or approved equal

#### 2.02 MATERIALS AND FINISHES

- A. Conform to NEMA VE 1.
- B. Cable Trays, Fittings, and Accessories: Steel, hot-dipped galvanized after fabrication conforming to ASTM A 123, Class B2.
- C. Protect steel hardware against corrosion by galvanizing conforming to ASTM B 633 or cadmium plating conforming to ASTM B 766.
- D. Fabricate cable tray products with rounded edges and smooth surfaces.

#### 2.03 SIZES AND CONFIGURATIONS

- A. Conform to NEMA VE 1.
- B. Ladder-Type Trays: Class 20C unless indicated.
  1. Width: 24 inches (610 mm).
  2. Inside Depth: 4 inches (102 mm).
  3. Cross-Rung Spacing: 12 inches (229 mm) o.c.
  4. Minimum Fitting Radius: 24 inches (610 mm).

#### 2.04 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, manufactured with the same materials and finishes as the cable trays.
- B. Covers: Louvered type, of same materials and finishes as cable trays.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.05 FIRESTOPPING

- A. Materials: UL listed and labeled and FM approved for fire ratings consistent with penetrated barriers.
- B. Materials: NRTL listed and labeled for fire ratings consistent with penetrated barriers.
- C. Sleeves: Schedule 40, welded, black steel pipe sleeves. Sizes as indicated or minimum NEC size for cable or cable group to be installed.
- D. Sealing Fittings: Suitable for sealing cables in sleeves or core drilled holes.
- E. Sealing Mortar: Suitable for sealing cable penetration slots/openings in fire barriers.
- F. Sealant: One-part compound for sealing cables, sleeves, and openings in fire barriers.
- G. Two-Part Sealant: Formed-in-place sealant as specified in Division 7 Section "Firestopping."

## 2.06 WARNING SIGNS

- A. Lettering: 1-1/2 inch (40 mm) high, black on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
- B. Materials and Fastening: Conform to Division 16, Section "Electrical Identification."

## 2.07 SOURCE QUALITY CONTROL

- A. Perform design and production tests according to NEMA VE 1.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine surfaces to receive cable tray for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.02 WIRING METHODS

- A. Use cable tray of indicated types and sizes, complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

## 3.03 INSTALLATION

- A. Install cable tray level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.

- B. Remove burrs and sharp edges of cable trays.
- C. Fasten cable tray supports securely to the building structure as specified in Division 16 Section "Supporting Devices" unless otherwise indicated.
  - 1. Locate and install supports according to recommendations of NEMA VE 1.
  - 2. Design supports, including fastenings to the structure, to carry the greater of the calculated load multiplied by a safety factor of 4, or the calculated load plus 200 lbs (90 kg).
- D. Make connections to equipment with flanged fittings fastened to the tray and to the equipment. Support the tray independently of fittings. Do not carry the weight of the tray on the equipment enclosure.
- E. Install expansion connectors in cable tray runs that exceed 90 feet (27 m). Space connectors and set gaps according to NEMA VE 1.
- F. Make changes in direction and elevation using standard fittings.
- G. Make cable tray connections using standard fittings.
- H. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- I. Firestop penetrations through fire and smoke barriers according to Division 7 Section "Firestopping."
- J. Firestop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- K. Sleeves for Future Cables: Install capped sleeves for future cables through firestopped cable tray penetrations of fire and smoke barriers.
- L. Working Space: Install cable trays with sufficient space to permit access for installing cables.
- M. Install barriers to separate cables of different systems, such as power, communications, and data processing, or different insulation levels, such as 600 V, 5,000 V, and 15,000 V.
- N. Install covers after installation of cable is completed.

#### 3.04 GROUNDING

- A. Connect cable trays to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

#### 3.05 WARNING SIGNS

- A. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

#### 3.06 FIELD QUALITY CONTROL

- A. Grounding: Test cable trays to ensure electrical continuity of bonding and grounding connections.



- B. Anchorage: Test pull-out resistance of one of each type, size, and anchorage material for toggle bolts and powder-driven threaded studs.
  - 1. Furnish equipment, including jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain Architect's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener.
- C. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

### 3.07 CLEANING

- A. Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

### 3.08 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that the cable tray is without damage or deterioration at Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by the tray manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the tray manufacturer.

END OF SECTION 270536



## SECTION 271000 – STRUCTURED CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Wire, cable, and connecting devices for wiring systems to be used as signal pathway or voice, and high-speed data transmission.
- B. System Diagram: Refer to T-Drawings

### PART 2 - PRODUCT

#### 2.1 MATERIALS

- A. Acceptable Manufacturers
  - 1. Belden CDT Inc.; Electronics Division.
  - 2. Berk-Tek; a Nexans company.
  - 3. CommScope, Inc.
  - 4. Or approved equal.

#### 2.2 TWISTED – PAIR CABLES, CONNECTORS AND TERMINAL EQUIPMENT

- A. Voice Backbone, 100 Pair Category 6 UTP cable.
- B. Conductors: Solid copper conductors
- C. Cross-connect panel rack mounted
- D. Patch panel, rack mounted
- E. Horizontal UTP, 4-pair Category 6
- F. Workstation Outlets: Category 6 jack-connector assemblies.

#### 2.3 FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT:

- A. Cables: Factory fabricated, jacketed, glass type, multimode, graded index.
- B. Backbone, Strands per cable: 12 (6 pair)
- C. Patch panel Rack mounted

#### 2.4 COAXIAL CABLES, CONNECTORS AND TERMINAL EQUIPMENT

- A. Video Backbone: RG11 with double braid and tape shield.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATION OF MEDIA

- A. Backbone Cable for Data Service: Use multi-mode fiber-optic cable for runs between equipment rooms and wiring closets and for runs between wiring closets.
- B. Backbone Cable for Voice Service: Use UTP Category 3, 100 pair, for runs between equipment rooms and wiring closets and for runs between wiring closets.
- C. Horizontal Cable for Data Service: Use UTP Category 6 cable for runs between wiring closets (MDF/IDFs) and workstation outlets.
- D. Horizontal Cable for Voice Service: Use UTP Category 6 cable for runs between wiring closets (MDF/IDFs) and workstation outlets.

### 3.3 INSTALLATION

- A. Wiring Method: Install wiring and optical fiber in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- B. Install cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- C. Install cables without damaging conductors, shield, or jacket.
- D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  - 1. Pull cables simultaneously if more than one is being installed in same raceway.
  - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
  - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips that will not damage media or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
- G. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

- H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radius than minimums recommended by manufacturer.
- I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.
- J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- K. Use splice and tap connectors compatible with media types.

#### 3.4 GROUNDING

- A. Ground cable shields, run conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
- C. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.
- D. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

#### 3.5 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

- A. Install plywood backboards (furnished by others) on walls of equipment rooms and wiring closets.
- B. Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.
- C. Group connecting hardware for cables into separate logical fields.
- D. Use patch panels to terminate cables entering the space, unless otherwise indicated.

#### 3.6 INSTALLATION STANDARDS

- A. Comply with requirements in TIA/EIA-568-A and TIA/EIA-569-A.

#### 3.7 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in TIA/EIA-606.
- B. Workstation: Label cables within outlet boxes.
- C. Distribution Racks and Frames: Label each unit and field within that unit.

- D. Within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Cables, General: Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
- F. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m)
- G. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project, in software and format selected by the Authority.
- H. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606. Furnish electronic record of all drawings, in software and format selected by the Authority.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
  - 2. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bi-directional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-TSB 67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA-568-A.
  - 3. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

### 3.9 TESTING, IDENTIFICATION AND ADMINISTRATION

- A. Copper Cable
  - 1. All Category 6 UTP cable shall be tested to a frequency of 350MHz to demonstrate compliance with the individual manufacturers advertised electrical characteristics.

2. All Category 6 UTP cable shall be field-tested with connectivity products installed to a frequency of 250MHz to demonstrate performance equal to or better than the minimum requirements as specified in ANSI/TIA/EIA-568b.2.1 and as listed in Table 1.
3. The Test Model shall be Permanent Link

TABLE 1 - Category 6 Permanent Link Limits in dB per ANSI/TIA/EIA-568B.2-1

Parameter	Performance @ 100MHz	Performance @ 200MHz	Performance @ 250MHz	Performance @ 300MHz
Insertion Loss	19.0 dB	27.4 dB	30.9 dB	34.1 dB
NEXT Loss	43.9 dB	39.3 dB	37.8 dB	36.6 dB
PS NEXT Loss	41.9 dB	37.3 dB	35.8 dB	34.6 dB
ACR	24.9 dB	11.9 dB	6.9 dB	2.5 dB
PS ACR	22.9 dB	9.9 dB	4.9 dB	0.5 dB
ELFEXT	26.3 dB	20.3 dB	18.3 dB	16.8 dB
PS ELFEXT	23.4 dB	17.3 dB	15.4 dB	13.8 dB
Return Loss	14.7 dB	11.7 dB	10.7 dB	9.9 dB
Propagation Delay	528 ns	527 ns	526 ns	526 ns
Delay Skew	40 ns	40 ns	40 ns	40 ns

4. All testing shall be performed with a UTP/ScTP field test device that has been factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
5. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
6. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
7. UTP horizontal and backbone cables shall be 100 percent tested according to ANSI/TIA/EIA-TSB-67 and ANSI/TIA/EIA-568-B.2.1. Test parameters include wire map plus shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return Loss, attenuation, propagation delay, and delay skew.

#### B. Fiber Optic Cable

1. Backbone
  - a. Fiber backbone cables shall be 100% tested for attenuation and length.
  - b. Attenuation shall be tested at 850 nm and 1300 nm for 50/125 nm multimode in at least one direction using the 2-jumper method.
  - c. Acceptable attenuation test results shall be determined using the following calculation:
    - 1) Link attenuation = cable attenuation + connector attenuation + splice attenuation.
    - 2) Cable attenuation, connector attenuation and splice attenuation are determined by each of the following formulas:
      - a) Cable Attenuation:  
 Cable attn. (dB) = Attn. coefficient (dB/km) x length (km)  
 Attenuation Coefficient = 3.0 dB/km @ 850 nm

- b) Connector Attenuation:  
Connector attn. (dB) = number of connector pairs x connector loss = 2 x 0.65 dB = 1.3 dB
    - c) Splice Attenuation:  
Splice attn. (dB) = number of splices (s) x splice loss (dB) = s x 0.3 dB
  - d. The Backbone Channel performance guarantees are as follows:
    - 1) Max Attenuation 850/1300 nm: 3.0/1.0 dB 2) Bandwidth 850/1300 nm: 1500/500 MHz/km
    - 3) ☐ Min. Return Loss: 20dB
    - 4) For each additional mated pair of connectors, add the following to the attenuation values as noted in above chart:
      - a) add 0.75 dB @ 850nm
      - b) add 0.65 dB @ 1300nm
    - 5) For each splice, add 0.30 dB to the attenuation values as noted in above chart (applicable to both M/M and S/M).

### 3.10 CUTOVER

- A. The contractor shall place cross connects at Telecommunication Equipment Rooms.

### 3.11 Training

- A. Authority training shall include:
  - 1. Physical review of installed cable plant.
  - 2. Review of cable plant documentation and test results.
  - 3. Instructions on industry standard termination and testing methods to enable customer personnel to successfully terminate and test cabling.

### 3.12 DEMONSTRATION

- A. Train the Authority's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets.

END OF SECTION 271000



## SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications pathways.
4. Grounding.

##### B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
3. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

#### 1.2 SUBMITTALS

##### A. Product Data: For each type of product indicated.

##### B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies, and location and size of each field connection.
2. Equipment racks and cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail.

##### C. Qualification Data: For BICSI RCDD or experienced equivalent qualified layout technician, installation supervisor, and field inspector.

#### 1.3 QUALITY ASSURANCE

##### A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD to be specified on the drawings.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A and NFPA 70.

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames, cable trays and cabling until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

### PART 2 - PRODUCTS

#### 2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
  - 2. Neatly support cabling and brackets; utilize cable tie slots for fastening cable ties to brackets, lacing bars, spools, J-hooks, and D-rings, Straps and other devices.
    - a. .
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
  - 2. Increase effective depth of 4" square boxes by adding extensions to meet depth requirements. Plaster ring depth can be used to meet depth requirement.

## 2.2 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. All grounding conductors for communications shall be copper.
- C. Telecommunications Main Bus Bar:
  - 1. Connectors: Mechanical type, cast silicon bronze, solderless-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
  - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
  - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- D. Comply with ANSI-J-STD-607-A.

## 2.3 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground/buried/aerial pathways complying with design documents and recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- C. Install underground/buried/aerial entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems." INSTALLATION
- D. Comply with NECA 1.
- E. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- F. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- G. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- H. Cables shall not be installed using building steel as a cable support.

### 3.2 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.3 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar in each IDF with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to the grounding bus bar in the MDF.
- D. Connect grounding bus bar in the MDF to the grounding electrode of the panel serving the MDF equipment with 2 minimum No. 4 AWG conductor.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

## SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. Fiber Optic cable.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

#### 1.2 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics including the following:
  - a. Cross-connects.
  - b. Patch panels.
  - c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
  5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
- C. Qualification Data: For RCDD qualified layout technician, installation supervisor, and field inspector.
  - D. Warranty: Provide manufacturer's system warranty against electrical or mechanical defects for 2 years from date of final acceptance.
  - E. Source quality-control reports.
  - F. Field quality-control reports.
  - G. Maintenance data.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings and Cabling detail /administration Drawings by an RCDD.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A and NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
  - 2. Neatly support cabling and brackets; utilize cable tie slots for fastening cable ties to brackets, lacing bars, spools, J-hooks, and D-rings, Straps and other devices.

### 2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden CDT Inc.; Electronics Division.
  - 2. CommScope, Inc.
  - 3. Leviton
  - 4. Superior Essex Inc.
  - 5. SYSTIMAX Solutions; a CommScope Inc. brand.
- B. Description: 100-ohm, 100 -pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-B.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG
    - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX.
    - e. Multipurpose: Type MP or MPG.
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

### 2.3 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Premise Wiring.
  - 2. Leviton Voice & Data Division.
  - 3. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair Category 6 conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made (pre-fab), 4-pair cables in 36 and 48-inch lengths; terminated with 8-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

## 2.4 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.



## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.

- B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-footlong service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

- C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

- D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

- E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

- F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
  - 1. Administration Class: 2
  - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements specified on drawings and/or in of this standard.
- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- F. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.8 FIELD QUALITY CONTROL

#### A. Tests and Inspections:

1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Prepare test and inspection reports.

END OF SECTION 271300



## SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling identification products.
7. Cabling administration system

##### B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

#### 1.2 HORIZONTAL CABLING DESCRIPTION

##### A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

#### 1.3 PERFORMANCE REQUIREMENTS

##### A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

#### 1.4 SUBMITTALS

##### A. Product Data: For each type of product indicated.

##### B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  3. Cabling administration drawings and printouts.
  4. Wiring diagrams to show typical wiring schematics, including the following:
    - a. Cross-connects.
    - b. Patch panels.
    - c. Patch cords.
  5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
  6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
- C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.
  - D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
  - E. Source quality-control reports.
  - F. Field quality-control reports.
  - G. Maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, and field testing program development by an RCDD.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.



## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Cable Trays:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cablofil Inc.
    - b. Cooper B-Line, Inc.
    - c. Chatsworth Products Inc.
    - d. Or Approved Equal
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

### 2.2 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
  - 1. Connectors: Mechanical type, cast silicon bronze, solderless-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
  - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
  - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

## 2.3 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.4 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden CDT Inc.; Electronics Division.
  - 2. Leviton
  - 3. Superior Essex Inc.
  - 4. Or Approved Equal.
- B. Description: 100-ohm, 100 -pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-B.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG
    - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX.
    - e. Multipurpose: Type MP or MPG.
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

## 2.5 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Leviton Voice & Data Division.
  - 2. Hubbell Premise Wiring.
  - 3. Panduit Corp.
  - 4. Or Approved Equal
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair Category 6 conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made (pre-fab), 4-pair cables in 36 and 48-inch lengths; terminated with 8-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  2. Patch cords shall have color-coded boots for circuit identification.

## 2.6 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Superior Essex
  2. Chatsworth Products, Inc.
  3. Leviton Inc.
  4. Hubbell Premise Wiring.
  5. Or Approved Equal.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
1. Number of Terminals per Field: One for each conductor in assigned cables.
  2. Number of Connectors per Field:
    - a. One for each four-pair UTP cable indicated.
    - b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
  3. Mounting: as indicated in construction drawings
  4. NRTL listed as complying with UL 50 and UL 1863.
  5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

## 2.7 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chatsworth Products, Inc.
  2. Leviton Inc.

3. Hubbell Premise Wiring.
  4. Or Approved Equal.
- B. Description: MUTOAs shall meet the requirements for cable connecting hardware.
1. Number of Terminals per Field: One for each conductor in assigned cables.
  2. Number of Connectors per Field:
    - a. One for each four-pair UTP cable indicated.
    - b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
  3. Mounting: as indicated in construction drawings.
  4. NRTL listed as complying with UL 50 and UL 1863.
  5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
  6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

## 2.8 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Two or Four-port-connector assemblies mounted in single or multigang faceplate as indicated in the construction drawings.
1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices."
  2. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
  3. For use with snap-in jacks accommodating any combination of UTP work area cords.
    - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
  4. Legend: Factory labeled by silk-screening or engraving for stainless steel faceplates.
  5. Legend: Machine printed, in the field, using adhesive-tape label.
  6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## 2.9 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## 2.10 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

## 2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used as specified in the construction drawings. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. MUTOA shall not be used as a cross-connect point.
  - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
    - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
  - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  - 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 12. In the communications equipment room, install a 10-foot long service loop on each end of cable.
  - 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
  - 1. Administration Class: 2.
  - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration, including optional identification requirements of this standard.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- F. Cable and Wire Identification:



1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
  6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.8 FIELD QUALITY CONTROL

#### A. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. UTP Performance Tests:
  - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

- 1) Wire map.
  - 2) Length (physical vs. electrical, and length requirements).
  - 3) Insertion loss.
  - 4) Near-end crosstalk (NEXT) loss.
  - 5) Power sum near-end crosstalk (PSNEXT) loss.
  - 6) Equal-level far-end crosstalk (ELFEXT).
  - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
  - 8) Return loss.
  - 9) Propagation delay.
  - 10) Delay skew.
6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
- a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
  - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. Prepare test and inspection reports.
- 3.9 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500

## SECTION 272000 – DATA COMMUNICATIONS

### PART 1 - CODES, STANDARDS, AND REGULATIONS

- 1.1 Communication design shall comply with Federal and State codes, regulations, and standards with variances adopted as standards by the NJSDA. Applicable state and national standards include the latest editions of:
- A. ANSI/NFPA 70 National Electrical Code with New Jersey Amendments
  - B. BICSI CO-OSP Customer Owned Outside Plant Manual
  - C. BICSI 12th Edition Telecommunications Distribution Methods Manual
  - D. BICSI 3rd Edition Customer Owned Outside Plant Design Manual
  - E. EIA Standard EIA-230 - Color Marking of Thermoplastic Wire
  - F. FCC Rules and Regulations:
    - 1. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications National Electrical Safety Code
    - 2. NFPA 101: Life Safety Code REA Standards for Engineering, Construct
    - 3. TIA 526-14-A Optical Power Loss Measurements for Installed Multimode Fiber Cable Plant-OFSTP-7
    - 4. TIA 568-C Commercial Building Telecommunications Cabling
    - 5. TIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
    - 6. TIA Standard ANSI/TIA/EIA-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
    - 7. TIA 604 Standards on Fiber Optic Connector Intermateability
    - 8. TIA 606-A Administration Standard for Commercial Telecommunications Infrastructure Standard
    - 9. TIA 758-A Customer Owned Outside Plant Telecommunications Cabling Standard
    - 10. TIA Telecommunication Systems Bulletin TSB67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
    - 11. TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
    - 12. In the event of a conflict between the Electrical Standards (D50, D60 and D70) and other guidance documents, the Education Specifications, the SDA's Kit of Parts, Bridging Documents also known as the Design Builder's Information Package and presiding codes shall take precedence.
- 1.2 Data Communications Network Equipment/Design Approach:
- A. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) Description:
    - 1. Main Distribution Frame (MDF) - A Main Distribution Frame shall be provided to distribute connectivity to the IDF, station cabling as required and to house the main control equipment of the following systems:
      - a. Local Area Network
      - b. Wide Area Network
      - c. Carrier/Service Provider Interconnections
      - d. Telephone System

- e. Paging/Intercom System
  - f. Clock Systems
  - g. Internet Protocol Digital Video Surveillance (IPDVS) System
  - h. Digital Video Distribution System
  - i. Building Management System
2. Any station cabling that does not exceed 80-Meters (262 Feet) in length shall be homerun to the Main Distribution Frame.
  3. Intermediate Distribution Frame (IDF) - Intermediate Distribution Frame shall be provided to distribute core connectivity from the MDF to station cabling where cable distances exceed 80-Meters (262 Feet) to the MDF
  4. The designated MDF shall have a single room UPS capable of supporting all devices within the room for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  5. For room based UPS Systems a bypass mode shall be included and must provide an alternate path for utility power to the connected load in the event of planned maintenance activities or a UPS malfunction.
  6. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  7. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  8. All server cabinets housed in the MDF shall have 48 Port Category 6 Compliant 110- type rack-mounted patch panels provided on the "rear" of the cabinet. This panel shall terminate on a 2 post telecom/network rack to supply network connectivity for devices inside the cabinets.
  9. Controlled access to the Main Telecommunications Room and Intermediate Telecommunications Closet shall be provided. This can be accomplished with a lock, card reader or other approved mechanism.
  10. The Main Telecommunications Room shall be built in accordance with "DCA Best Practices Standards for Schools under Construction or Planned for Construction."

B. Routing – at a Minimum Routers Must Support:

1. Open Shortest Path First (OSPF)
2. Enhanced Interior Gateway Routing Protocol (EIGRP)
3. Routing Information Protocol (RIP), and RIPv2
4. Two (2) - 10/100/1000-T Copper based
5. One (1) - Small form-factor pluggable (SFP) based slot
6. Four (4) - Enhanced High-Speed WAN Interface Cards (EHWIC)
7. Three (3) Digital Signal Processors (DSP) slots
8. One (1) Internal Services Module (ISM) slot
9. Flash: Support up to 4 GB (Gigabytes)
10. RAM: Support up to 2.5 GB (Gigabytes)
11. RJ-45 Console serial port and USB Console Serial Port
12. Management Capabilities via IP / SNMP / Telnet / SSH / HTTP(S)

C. Switching - at a Minimum Switches Must Support:

1. MDF – A core switch housed within the MDF must meet these minimum requirements:
2. Modular Chassis Switch with 7, 9 or 13 Slots
3. Supervisor engine redundancy
4. 19" (19-inch) rack compatible
5. Redundant 4200W Power Supply
6. IEEE 802.3af/at compliant PoE/PoEP
7. Hot swappable
8. 280-Gbps (Gigabits per second) switching capacity
9. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path
10. First (OSPF), Routing Information Protocol (RIPv2)
11. IEEE 802.1Q VLAN Encapsulation 12. 802.1s, 802.1w, 802.3ad
12. 13. 802.3af/at (PoE)
13. Ether Channel bonding across line cards
14. Port Aggregation Protocol (PAgP)
15. Voice VLAN and VLAN ID (VVID)
16. Jumbo Frames (up to 9216 bytes)
17. Traffic Storm Control and/or Broadcast/Multicast Suppression
18. Bridge Protocol Data Unit (BPDU) Guard
19. Link Layer Discovery Protocol (LLDP)
20. Switches housed in MDF and IDF rooms support 10 Gigabit Ethernet Connectivity between IDF and MDF rooms. 1-Gigabit Ethernet Connectivity to each station drop.

D. IDF - Switches Housed Within the IDF Must Meet These Minimum Requirements:

1. Stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.
2. Inter-connection via a channel or bus cable
3. 1100W (minimum) Power Supply
4. Power over Ethernet (PoE) capable on all copper based ports. 802.3af and 802.3at Standards
5. All ports must support 1-Gigabit Ethernet connectivity
6. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Information Protocol (RIPv2)
7. Wireless Data (Wi-Fi) Communications System - A wireless access network shall span all occupy able spaces through the entire facility.
8. Must utilize a centralized controller that allows management of wireless network as a whole.
  - a. Allow for management of individual access points.
  - b. Application of site wide wireless access policies.
9. Shall be capable of providing:
  - a. IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac
  - b. Encryption WEP and TKIP-MIC; SSL and TLS; AES (CCM, CCMP)
  - c. Authentication, Authorization, and Accounting (AAA); IEEE 802.1X; RADIUS; PPP EAP-TLS; Extensible Authentication Protocol (EAP) with RADIUS
10. Wireless Node Isolation.
11. IEEE 802.1Q VLAN tagging; intra-VLAN security; VLAN Isolation

## PART 2 - VOICE COMMUNICATIONS

### 2.1 Telephone System Description

#### A. General

1. The intent is to provide a school wide Voice over IP (VoIP) Telephone System with voicemail capabilities. The Telephone System and the Data Systems shall share physical cabling mediums and strive for maximum integration.

#### B. Equipment and Locations

1. All processing and head end systems required for voice communications shall be housed in the Main Distribution Frame (MDF) room.
2. Telephones outlet and handset shall be provided in all administrative areas, class rooms, offices, security desks and other specified locations.
3. Wall telephone outlet without lock box and handset shall be provided in utility rooms, storage rooms greater than 200 sq. ft., mechanical rooms, elevator machine room, supply rooms and vault room.
4. Dedicated phone lines (not through the IP Private Branch Exchange (PBX)) shall be provided for the Intrusion Alarm System, Fire Pump, and Elevator Intercom System.
5. A loud Bell is to be placed in noisy areas including the auditorium, gymnasium, gymnasium, student cafeteria, kitchen and the boiler room. A loud bell may be required in other noisy areas; however, this will be addressed on a case by case basis and will be determined by the contract documents.

## PART 3 - VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT

### 3.1 Internet Protocol Private Branch Exchange (IP PBX) Minimum Requirements

- A. H.323 and SCCP protocol support
- B. IP Based SIP, Digital (PRI / BRI) and POTS line carrier interface (Trunk)
- C. Analog Telephone Adaptor (ATA)/ Foreign eXchange Subscriber (FXS) Adapter support up to 20 line appearances per phone
- D. Support of fallback service phone auto-registration
- E. IP Handsets; Software phone client.
- F. Foreign eXchange Office (FXO) interface for analog systems.
- G. E911 with two emergency location numbers per zone; unlimited zones per site
- H. Paging: Internal through IP phones or to external paging system
- I. Ad-hoc conferencing
- J. Push Button intercom and Night Bell capabilities.
- K. Multiple music-on-hold (MoH) streams (internal/external)

## PART 4 - VOICE COMMUNICATIONS TERMINAL EQUIPMENT

### 4.1 Telephone Set Type: Minimum Capabilities, Requirements

#### A. Executive/Administrative offices

1. Six (6) Physical Lighted Line Appearance keys
2. Two way Speaker Phone
3. Support for expansion module with additional line keys
4. 802.3af Power Over Ethernet (PoE) support.
5. Integrated 10/100 switch.

#### B. Classroom / Shared Spaces

1. Two (2) Physical Lighted Line Appearance keys
2. Two way Speaker Phone
3. 802.3 af Power Over Ethernet (PoE) support.
4. Integrated 10/100 switch.

#### C. Public areas / Miscellaneous Spaces

1. 1 line (May use 0 line keys)
2. 802.3 af Power Over Ethernet (PoE) support.

#### D. Conference Rooms / Conference Phones

1. Support for external microphone kit
2. 802.3 af Power Over Ethernet PoE support.
3. Door Phone / Push button Intercom
4. Door Intercom w/ doorstrike release
5. Vandal resistant / Hardened
6. Phone system integrated

### 4.2 Elevator Intercommunication System

- A. Elevator car stations shall have an auto-dialer and a time-clock switch programmable to dial primary and secondary numbers.
- B. Connect the automatic dialing, hands-free station in the elevator car to a dedicated telephone line. The elevator car station shall automatically dial a programmed number to alert the school personnel that there is a problem in the elevator and identify visually which elevator is initiating the call.
- C. The primary number shall ring in the General Office, while the secondary number shall ring the elevator installer. Dedicated phone lines (not through the Private Branch Exchange (PBX)) shall be provided for the Elevator Intercommunication System
- D. Provide a telephone set within Elevator Machine Rooms, as part of school telephone system.

END OF SECTION 272000





## SECTION 272100 – DATA COMMUNICATIONS NETWORK EQUIPMENT

### PART 1 - GENERAL GUIDELINES

#### 1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Data Communications Network Infrastructure

#### 1.2 SECTION INCLUDES

##### A. DATA COMMUNICATIONS NETWORK EQUIPMENT

1. File/Building Server – optional.
2. Network Switches.
3. Network Core Switch.
4. Network Security Equipment.
5. Uninterruptible Power Supplies (UPSs).

#### 1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ®BICSI Telecommunications Distribution Methods Manual (TDMM).

#### 1.4 SYSTEM WARRANTY

- A. The Local Area Network Electronics and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Authority for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

#### 1.5 GENERAL

- A. Each Building shall be provided with a Local Area Network (LAN) System.
- B. Existing Facilities that are being remodeled shall be upgraded to the current requirements stated herein.
- C. Single Building projects shall be compatible with the existing network infrastructure.
- D. Wide Area Network (WAN) Interfaces shall be provided to interface the Authority's WAN provider. Coordinate WAN requirement with the Authority's fiber provider as applicable.
- E. Buildings shall be designed as to minimize the quantity of Telecommunications Rooms and to centralize as much of the Data Network Equipment as possible.
- F. Multiple buildings on the same campus should be designed to share common Data Network Electronics and equipment wherever possible.

- G. The Authority should design their Data Networks to take advantage of Centralization of Common Network Equipment at a Network Operations Center(s).
- H. Items that should be centralized include:
  - 1. File/Building Servers.
  - 2. L-3 Routing Devices.
  - 3. Network Management Equipment.
  - 4. Security Devices, Radius Servers, etc.
  - 5. WAN access equipment.
  - 6. Wireless Management Equipment.
- I. As a minimum, the Network may be used to support the following applications on a Local and Wide Area basis:
  - 1. Automation Systems.
  - 2. Clock Systems.
  - 3. Control Systems.
  - 4. Data Networking
  - 5. Security Systems.
  - 6. Video Conferencing.
  - 7. Video Streaming/Media Retrieval.
  - 8. VoIP Telecommunications.
  - 9. Wireless Access Points.

#### 1.6 FILE/BUILDING SERVER

- A. Provide Network File/Building Server for the central administration and storage of computer files and information. The Networked Server shall be of a current design criteria, utilizing SAS 10k-15k rpm RAID level 5 hard drive storage (minimum 2TB)--Quad core processor. Coordinate OS with the Authority. Min. 64-bit Windows Server 2008 if Windows based. Minimum 16 GB of RAM, 2 x 10Gig NIC. Attach to Core via 10 Gig DAC. 22" LED monitor, rack mounted.
- B. Provide Operating System based on the Authority's requirements.

#### 1.7 NETWORK SWITCHES

- A. Proprietary Specifications:
  - 1. The following product/manufacture has been approved by the Authority for proprietary specifications and use in this project.
    - a. Network Switches: Cisco
  - 2. Subject to compliance with codes and all project requirements, the Contractor is required to use the indicated product/manufacture and to verify compatibility with the existing systems.
- B. Provide 1000 Base T Layer 2 Manageable Ethernet Switches with ports in a quantity to support all initially planned devices, including wireless access points, with 15% spare.
- C. Provide a configuration of switch ports utilizing either stackable edge switches or a modular chassis with single engine and dual PS.
  - 1. Provide dual 10GB uplinks to each switch stack or modular chassis.

- D. The 1000 switches shall be “non-blocking” and support a minimum forwarding bandwidth equal to the number of switch ports x 1 Gbps.
- E. Utilize 10GB uplinks for all uplinks. Switches may be stacked, but provide each stack with a minimum of two uplinks for redundancy.
- F. Chassis mounted units are acceptable for Edge Switches, provided that dual power supplies and equivalent uplink bandwidth is supplied.
- G. The Network switches shall support advanced services such as:
  - 1. IP Telephony.
  - 2. Wireless Access Points.
  - 3. Building Management Systems.
  - 4. Video Streaming.
  - 5. IP CCTV/Access Control
- H. POE+ switches shall be rated to provide POE+ class 3 on all ports simultaneously. Standard 30 watts per port. Reference 802.3at standard.
- I. The 1000 switches shall support the following features and specifications:
  - 1. 1000BASE-LX/LH.
  - 2. 1000BASE-SX.
  - 3. 1000BASE-X (SFP).
  - 4. 1000BASE-ZX.
  - 5. Access Control Lists (ACL).
  - 6. Advanced QoS.
  - 7. IEEE 802.1s.
  - 8. IEEE 802.1D Spanning Tree Protocol.
  - 9. IEEE 802.1p CoS Prioritization.
  - 10. IEEE 802.1Q VLAN.
  - 11. IEEE 802.1s.
  - 12. IEEE 802.1w.
  - 13. IEEE 802.1x.
  - 14. IEEE 802.3 10BASE-T specification.
  - 15. IEEE 802.3ab 1000BASE-T specification.
  - 16. IEEE 802.3ad.
  - 17. IEEE 802.3af and 802.11at POE.
  - 18. IEEE 802.3u 100BASE-TX specification.
  - 19. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports.
  - 20. IEEE 802.3z 1000BASE-X specification.
  - 21. IPv6.
  - 22. Rapid Spanning Tree.
  - 23. Rate Limiting.
  - 24. RMON I and II standards.
  - 25. SNMPv1, SNMPv2c, and SNMPv3.
- J. Provide sufficient 1000 ports to accommodate, as a minimum, the following devices as required:
  - 1. Access Control System.
  - 2. Admin PCs.
  - 3. Classroom PC Devices.
  - 4. Clock Systems.

5. Distant Learning Systems.
  6. Instructor PCs.
  7. Monitor/TVs, as required.
  8. MPEG Encoders.
  9. PABX System.
  10. Printers.
  11. Projectors.
  12. Set Top Boxes, as required.
  13. UPS Units.
- K. Provide all GB POE+ ports to accommodate, as a minimum, the following devices as required:
1. IP Phones
  2. IP CCTV Cameras
  3. WLAN access points.
- L. Switches housed in MDF and IDF rooms support 10 Gigabit Ethernet Connectivity between IDF and MDF rooms. 1-Gigabit Ethernet Connectivity to each station drop.

## 1.8 NETWORK CORE SWITCH

- A. Provide a modular chassis-based central Layer-3 ethernet routing switch with advanced QoS to serve the entire building or campus. The Core switch shall be provided with backplane capacity to provide full non-blocking support of all installed line cards plus 15% growth.
- B. Equip the Central Layer-3 switch with a minimum of two (2) Power Supplies and two (2) Redundant Central Control/Supervisor Units.
- C. All Core switch Blades must support full line speed and shall not be over-subscribed.
- D. Provide sufficient Ports on the Layer-3 Core Switch, as a minimum, for the following devices:
1. Provide Network Switch uplink ports to support all edge switches plus 15% spare. The switch shall have at least one spare uplink card for redundancy.
  2. Building Automation Systems, as required (typically TX).
  3. CCTV DVR System (typically TX).
  4. File Servers (typically TX, 10GB).
  5. Firewall, as required (typically TX).
  6. Media Distribution Servers & Controllers (typically TX).
  7. Radius Authentication Server, as required, (typically TX).
  8. WAN Connectivity (typically LX or CWDM).
  9. Wireless Controllers (typically TX, 10GB).
  10. Wireless Phone Controller (typically TX).
  11. Wireless Control Console (typically TX).
- E. In addition to the above listed features and specifications for the Network Switches, the Network Core Switch shall support the following Features and Specifications:
1. 10 Gbps Support capabilities.
  2. BGP4 and Multicast Border Gateway Protocol (MBGP).
  3. Full Internet Control Message Protocol (ICMP) support.

4. Hot Standby Router Protocol (HSRP).
5. ICMP Router Discovery Protocol.
6. IGMP filtering.
7. IGMP v1, v2, and v3.
8. IP Multicast routing protocols.
9. IP routing protocols: EIGRP, OSPF, Routing Information Protocol (RIP), and RIP2.
10. Non-Blocking GBE Ports.
11. NSF awareness.
12. Policy-based routing (PBR).
13. Virtual Router Redundancy Protocol (VRRP).

## 1.9 NETWORK SECURITY EQUIPMENT

### A. RADIUS SERVER

1. If the Authority does not have a Central Radius Server, provide a Radius Server for Network Authentication, VLAN Assignment and Policy Assignment for IP Network Attached Devices.

### B. FIRE WALL

1. If the Authority does not have a Central Firewall and Intrusion Detection Device for connection to the Wide Area Network and Internet, provide a Firewall and Intrusion Detection Device for Protection and Security. Establish all Internet Connections via a Firewall.
2. Size the Firewall based on planned Network throughput, available WAN bandwidth and attached IP Devices.
3. Provide VPN services in the Firewall for remote access and network maintenance services.
4. Coordinate requirements with the Authority's Technology Department.

## 1.10 UNINTERRUPTIBLE POWER SUPPLIES (UPSs)

- A. Provide Dual Conversion UPS units for ER and TR Local area Network Electronics and File Server, providing sufficient protection from power anomalies.
- B. Provide Power strips, connected to the UPS Unit via twist-lock plugs. Locate the power strips in the equipment racks and on the equipment backboards for powering all electronics systems in the ER and TRs.
- C. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.
- D. Connect the UPS Units to Building Emergency Generator when available.
- E. For buildings without a Generator, supply a two-hour (2) standby.
- F. Provide shutdown connections from the UPS to servers for graceful power down in the event of a power failure.
- G. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
- H. Connect the UPS SNMP Management to the Management VLAN.

- I. Coordinate UPS voltage, circuit size, and connection requirements with the Electrical Design Professional.

#### 1.11 INSTALLATION

- A. Install File Server (optional) and setup basic user accounts and network configuration.
- B. Install Data Network Ethernet Switches and validate connectivity throughout. Establish all VLANs, QoS, IP Routing and IP Subnets.
- C. Consult with the Authority and consider providing the following VLANs as a minimum:
  - 1. Administration.
  - 2. HVAC.
  - 3. Management.
  - 4. Point of Sale.
  - 5. Student.
  - 6. Video.
  - 7. Voice.
  - 8. Wireless.
  - 9. Security, CCTV
- D. Coordinate network installation and integration with other systems connected to the network with the Authority's and applicable DA-Site's technical and operational requirements.
- E. Install and setup UPS units and establish power down procedures.

#### 1.12 LABELING AND MARKING

- A. Provide a typed schedule of all data ports according to each related room jack designation for all TRs, and ER, in accordance with the Authority's requirements.

#### 1.13 TESTING

- A. Test the system "end-to-end" (from TR to ER, and from TR to station jack) at the direction of the Design Professional and verify, in writing, that the data network system is in proper working condition.
- B. Verify and demonstrate proper operation of all switches, Access Points, VLANs, Routing, WAN Connectivity and possible ATM Connectivity with the Authority's and DA-Site representative, if applicable.

#### 1.14 TRAINING

- A. Provide a minimum of forty (40) hours of training to the Authority's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:
  - 1. System Equipment Connectivity
  - 2. Device Configurations
  - 3. Operation, maintenance, and upgrade procedures.
- B. Training to be arranged with Authority personnel. 40 hours should be spread out over

the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).

- C. Training to occur in maximum of 2 hour increments per personnel or groups of personnel.
- D. Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.
- E. Training shall be by certified manufacturer instructor.
- F. Training schedule shall be coordinated with Authority personnel and their needs.
- G. Training plan, time line, and agenda shall be provided to Authority IT personnel and signed off by the Authority and Contractor.
- H. Warranty certificate and agreement shall be provided to Authority IT personnel at initial training session.
- I. Provide a digital video copy of the training sessions.

END OF SECTION 272100





## SECTION 272102 – DATA SYSTEMS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work include in this section shall have one system integrator to coordinate with the following specification sections.
  - 1. 27 05 34 RACEWAYS, BOXES, AND CABINETS
  - 2. 27 05 36 CABLE TRAY FOR COMMUNICATIONS

#### 1.02 SUMMARY

- A. This Section includes the cable, network switches, connecting devices, wireless access points, patch panels, installation, and testing for wiring systems to be used as signal pathways for video and high-speed data transmission.
- B. One system integrator shall oversee all installations related to this specification and related documents listed in part 1.1.

#### 1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each component specified, including detailed manufacturer's specifications. Include data on features, ratings, and performance. Include dimensioned plan and elevation views of components. Show access and working-space requirements.
- C. Samples of Data outlet connectors, jacks, jack assemblies, and faceplates and evaluation of technical features.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Provide evidence of applicable registration or certification.
- E. Field test and observation reports indicating and interpreting test results relative to compliance with performance requirements of the installed systems.
- F. Maintenance data for products to include in the operation and maintenance manual.
- G. Final Documentation as specified in Part 3.
- H. Evidence of listing of products specified to be listed in the "Quality Assurance" Article.
- I. Shop Drawings:

1. Provide (3) sets of documents on cable certification results and AutoCAD files indicating cable location, labels and all connections.
- J. Extra Materials: Submit one month prior to date of Substantial Completion.
- K. Provide certification for Owner's maintenance personnel as verification of training.

#### 1.04 QUALITY ASSURANCE

- A. Installing Firm Must Be A Qualified Cabling Contractor With At Least Five Years Experience In The Installation, Testing And Adjustment Of Systems Similar To The System Specified Herein.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Work Coordination: Coordinate Work of this Section with Owner's telephone switch, telephone instrument, workstation, local area network (LAN), and wide area network (WAN) equipment suppliers. Coordinate the service entrance arrangement with the local exchange carrier.
  1. Meet jointly with representatives of the above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
  2. Record agreements reached in meetings and distribute record to other participants.
  3. Adjust the arrangements and locations of distribution frames and patch panels in equipment rooms and wiring closets to accommodate and optimize the arrangement and space requirements of the telephone switch, LAN and WAN equipment.

#### 1.05 WARRANTY

- A. Fifteen (15) year manufacturer's product warranty and 15-year performance warranty for all wiring system components, in writing directly from the manufacturer to the customer, and copied to the engineer. The performance warranty shall warrant the installed cabling system including data cables and fiber optic cables. Copper links shall be warranted against the link performance minimum expected results defined in TIA/EIA 568, tsb-67. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568, Annex h.

#### 1.06 STANDARDS

- A. All data and video cabling work must comply with federal, state and local codes. Any code or requirement found to be more stringent than in these contract documents shall take precedence over the contract documents, and will become a contract requirement. Contractor must identify and report any deviations being considered from the following standards:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA):

EIA/TIA-568 -- COMMERCIAL BUILDING CABLING STANDARDS AND IEEE 802.3X.

EIA/TIA-569-- COMMERCIAL BUILDING STANDARDS FOR TELECOMMUNICATIONS PATHWAYS AND SPACES.

EIA-TSB36—(TECHNICAL SYSTEMS BULLETIN 36) FOR CABLE SPECIFICATIONS.

EIA/TIA-TSB 67-TECHNICAL SYSTEMS BULLETIN 67)-- TESTING STANDARDS.

EIA/TIA-TSB 72—(TECHNICAL SYSTEMS BULLETIN 72)--CENTRALIZED OPTICAL FIBER CABLING.

EIA/TIA-TSB 75—(TECHNICAL SYSTEMS BULLETIN 75)--OPEN OFFICE CABLING.

EIA/TIA-606 ADMINISTRATION STANDARDS FOR TELECOMMUNICATIONS INFRASTRUCTURE.

EIA/TIA-607—COMMERCIAL BUILDING GROUNDING AND BONDING REQUIREMENTS FOR

TELECOMMUNICATIONS.

EIA/TIA-TSB40A (TECHNICAL SYSTEMS BULLETIN 40A)-- ADDITIONAL TRANSMISSION SPECIFICATIONS FOR UNSHIELDED, TWISTED-PAIR CONNECTING HARDWARE.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).

NFPA NUMBER 70.

NFPA ARTICLE 725-- REMOTE CONTROL, SIGNALING AND POWER-LIMITED CIRCUITS.

NFPA ARTICLE 800-- COMMUNICATIONS CIRCUITS.

NFPA ARTICLE 770—OPTICAL FIBER CABLES.

UNDERWRITERS LABORATORIES INC (UL).

UL 910—TEST METHOD FOR FIRE AND SMOKE CHARACTERISTICS OF ELECTRICAL AND OPTICAL-FIBER CABLE.

#### 1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Data Cable: 1000 feet size and type used for Project. Furnish on reels.
2. Patch Cords: (10) of each type and length used for Project.

3. Station Cables: (10) of each length used for Project.
4. Connecting Blocks: 1 of each type for each 100 installed, but not less than 1.
5. Faceplate./Jack Assemblies: (10) of each type for each 100 installed, but not less than 1.

#### 1.08 DELIVERY, STORAGE AND HANDLING

##### A. Fiber Optical Cable Delivery:

1. No cable over one year old when delivered to the site will be accepted.
2. Keep ends of cables sealed at all times, except when making splices or terminations. Use methods approved by cable manufacturer.
3. Include the following data durably marked on each reel:
  - a. Facility name and address.
  - b. Contractor's name.
  - c. Project title and number.
  - d. Date of manufacture.
  - e. Manufacturer's name.
  - f. Linear feet.

##### B. Cable Storage: Store where cable will be at temperature recommended by cable manufacturer for optimum workability.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

##### A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Products that may be incorporated in the Work include, but are not limited to, the following:

1. Cable:
  - a. Mohawk/CDT.
  - b. Commscope.
  - c. Belden
  - d. Amp
  - e. Cisco
  - f. Or approved equal
2. Connecting Devices:
  - a. Leviton
  - b. Krone
  - c. Amp

- d. Cornell
- e. Or approved equal

## 2.02 SYSTEM REQUIREMENTS

- A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, quantity of spare conductor pairs in cables, positions in patch panels, cross connects, spare room in equipment racks and terminal strips shall be adequate to accommodate a 10 percent future increase in active workstations.
- C. Installer shall determine the quantities of station runs, distribution (backbone) runs, patch panels and all necessary equipment to install data system.

## 2.03 WIRING PATHWAY AND EQUIPMENT MOUNTING ELEMENTS

- A. Distribution IDF Cabinets: Cabinet: Provide lockable, floor-mounted steel units designed for telecommunications terminal and equipment support and coordinated with dimensions of the units to be supported.
  - 1. Each wiring closet is to have adequate quantities of floor standing equipment racks to house patch panels, fiber housings, wire management, data switching equipment and expansion capability. Minimum requirements (2) cabinets for MDF-1, (1) cabinet for IDF-2 and (1) cabinet for IDF-3.
  - 2. Placement of the racks must adhere to applicable EIA/TIA standards for equipment room layout. If conflicts exist between field conditions and standards requirements, then it is the responsibility of the cabling contractor to bring this situation to the attention of the Owner and the engineer. Final locations shall be determined by Owner.
  - 3. Black, baked-polyester powder coat finish with smoked plexi-glass front with lock and (2) top mounted powered fans.
  - 4. Power strip with 10 surge protected outlets.
  - 5. Approximate Dimensions: 84 inches high by 22 inches wide (2130 mm high by 560 mm wide) overall. (For standard 19" wide rack mounted equipment).
- B. Wire Management
  - 1. Double sided horizontal wire management is to be installed above, between and below each patch panel and fiber housing.
  - 2. Top and bottom position wire managers are to be 1.5 inches
  - 3. Wire managers installed in between patch panels are to be 3.0 inches.
  - 4. Double sided, vertical wire management is to be installed down one side of each equipment rack. If multiple equipment racks will be located together in the same wiring closet, then vertical wire managers should be center-mounting type.

5. For Vertical Wire Managers, Minimum Channel Size For Each Channel (Front And Back) Is To Be 4 X4 Inches.

## 2.04 DATA CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

- A. Listed as Complying with Category 6 of EIA/TIA-568: Provide evidence of listing for all products specified in this Article.
- B. Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be blue in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- C. Wireless Access Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be yellow in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- D. Security Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be green in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- E. Patch Panels
  1. Patch panels are to be 48 port and 96 port, Category 6 utilizing EIA/TIA 568-B terminations.
  2. Panels are to be rack mounted with black anodized faceplates.
  3. Patch panels shall have 110 style connectors for the termination of station wiring.
  4. If A Patch Panel Port Is Not Functional, Or Cannot Pass Certification Testing, Then It shall be replaced Or The Entire Patch Panel.
- F. Face Plates and inserts
  1. Data Station faceplates shall be single gang and provide single, two, four, or six ports, dependant on the number of cables at the drop location. Faceplates are to house modular RJ-45 inserts as required.
  2. Data modular inserts shall be Category 6 and be flush mounted in faceplate. Terminating Procedures Must Strictly Adhere To The Eia/Tia 568-B Wiring Code.
  3. Faceplates shall have ample room to accommodate labeling as detailed further in this specification. Blanks shall be installed in all unused ports.
  4. All faceplates shall be compatible with floor boxes.
- G. Patch Cords: Red Category 6 patch cables in 24 and 36-inch lengths. Provide one for each patch panel port in the following quantities- 50% at 24 inch and 50% at 36 inch.
- H. Station Cables (for connecting computers & printers) : Provide one Blue Category 6 cable for each patch panel port in the following quantities- 25% at 5 foot, 25% at 10 foot, 25% at 15 foot and 25% at 25 foot.

## 2.05 FIBER OPTIC CABLE CONNECTORS AND EQUIPMENT

- A. Fiber Optic Connectors: Connectors shall be "ST" type, with epoxy-less crimp and ceramic ferrule. Connectors must be compatible with fiber optic cable used on the project. DB loss shall not exceed manufacturer's specified maximum loss per connector.
  - 1. Breakout kits shall be used for all "Loosetube" cables.
- B. Fiber Optic Distribution Panels: Panels shall be compatible with a 19" equipment rack and consist of an enclosure fitted with ST style multimode adapter plates for all fiber strands. Each panel shall provide 24 ports.
- C. Fiber Optic Termination Cabinet (FTC)
  - 1. 16 gauge steel enclosure with lock by Corning or equal.
  - 2. Adapter plate with factory mounted ST type multimode feed-thru adapters (number of adapters as required).
- D. Fiber Patch Cords:
  - 1. Duplex 50 micron/125 micron (core/clad) multimode optical fibers, with a UL rating of OFNR. Optical performance and manufacturer to be the same as specified for fiber optic cable.
  - 2. PVC outer jacket.
  - 3. Cable length of 1 meter.
  - 4. Connectors: Cables shall utilize dual ST-style to SC-style factory-terminated connectors.
  - 5. Quantity equal to the number of fiber connections in each wiring closet, plus one additional cable per closet.
- E. Fiber Optic Labels:
  - 1. One label shall be securely fastened to innerduct or fiber optic cable at all pull boxes, manholes, termination points and splice points.
  - 2. Labels shall be plastic laminate with engraved letters of 1/4 inch minimum. Labels shall contain fiber type, size and destination.
  - 3. Each fiber strand and ST connector shall be labeled with a printed label corresponding to an identical label at opposite end.

## 2.06 IDENTIFICATION PRODUCTS

- A. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

## 2.07 INSTALLATION PRODUCTS

- A. Cable Hooks: Steel hooks designed for support of cables; Arlington Industries "CH1M" series, or equal. Provide beam clamps, rods, or other hardware as needed to attach cable hooks to building structure.

- B. Sleeves: Provide at least one steel conduit sleeve (minimum size 1.5"), with plastic bushings on each end of conduit from each/every room where there are data and/or video drops. Sleeve shall run from room into hallway to allow for the routing of cabling to nearest data closet. Sleeve shall be installed above accessible ceilings and be placed to avoid mechanical, electric and plumbing work. Provide additional sleeves as required to accommodate number of cables.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine pathway elements to receive cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Wiring Method: Install cables in raceway system in all areas where cable will be exposed. In slab installation, cable is to be installed in PVC. Install pull string in raceways with wiring. Conceal cables except in unfinished spaces and within data closets. In locations with accessible ceilings, cables may be bundled and run above the ceiling supported on cable hooks .
- B. Back boxes: plastic insert boxes or insert rings with pressure mounts are not acceptable attachments. All cables terminated on wall plates should be contained within a metal electrical box
- C. Cable Routing shall be via the shortest route, and shall be as per EIA/TIA 568 Standards. Routing is to be determined by the Cabling Contactor unless otherwise indicated .
- D. Install cable without damaging conductors, shield, or jacket.
- E. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.
- F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  - 1. Pull cables simultaneously where more than one is being installed in the same raceway.
  - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.
- G. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- H. Secure and support cable not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- I. Wiring within data closets and Enclosures: Provide adequate length of conductors. Train the conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed.
- J. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.



- K. Provide conduit sleeves with protective bushing on ends required for routing of cables.

### 3.03 DATA CABLE INSTALLATION

- A. All voice and data cables are to be terminated . Pair twist must be maintained to within .5 inch of termination point.
- B. Install components as indicated, according to manufacturers' written instructions. Use techniques, practices, and methods that are consistent with EIA/TIA 568 standards.
- C. All data outlets shall be cabled with individual 4-pair cable with unbroken return to punch down on back of patch panels in closets.
  - 1. No splicing of cable will be allowed.
- D. All horizontal data cables shall be independently supported of building structure above suspended ceilings, tunnels, etc. The use of "j" hooks or equivalent hangers are required.
  - 1. Cable supports or hangers shall be placed at a minimum of 3 ½ foot intervals, or closer, to prevent sagging. Install hangers so that all cable is run in the same horizontal plane without rises and falls that cause radiuses in the cable.
  - 2. Cables shall be bundled in groups of not greater than 40 cables in order to insure that bottom cables are not deformed.
- E. Separation of Wires: Comply with EIA/TIA-569 rules for separation of unshielded copper data system cables from potential EMI sources, including electrical power lines and equipment.
  - 1. All telecommunications cabling should be separated from a/c power cables by a minimum distance of 12".
- F. Provide 3 feet of cable Slack On The Wiring Closet Side Of The Cables To Allow For Adjustment Of Rack And Patch Panel Positions.

### 3.04 FIBER OPTIC CABLE INSTALLATION

- A. All fiber optic cable must be installed with orange innerduct. Manufacturer's recommendations for maximum pulling tension and bend radius shall be observed. Cable lubricant shall be applied to all pulls through innerduct.
- B. All fiber optic cables must be continuous between distribution frames; no splices will be allowed.
- C. Fiber optic cables passing through pull boxes and manholes shall have a service loop of not less than once the inside perimeter of pull box or manhole. Loops shall be inclusive of innerduct.
- D. A service loop of no less than 20 ft. shall be fastened to building structure, in a secure location, at all termination points.
- E. All Fiber Optic Cable Strands Are To Be Terminated.

### 3.05 GROUNDING

- A. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- B. Bond shields and drain conductors to ground at only one point in each circuit.
- C. Signal Ground Terminal: Locate at each equipment room and wiring closet. Isolate from power system and equipment grounding.
- D. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements of Division 26 Section "Grounding."
- E. Signal Ground Bus: Mount on wall of main equipment room with stand-off insulators.
- F. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each wiring closet and equipment room.

### 3.06 INSTALLATION AT MDF/ IDF

- A. Mount patch panels, network switches, terminal strips, UPS units, Fiber Termination cabinets and other connecting hardware in racks, except as otherwise indicated.
- B. Group connecting hardware for cables into separate logical fields.
- C. Provide fiber connectivity to owners existing MDF racks and any associated equipment to complete connectivity.

### 3.07 LABELING

- A. Labeling shall conform to ANSI/TIA/EIA-606 standards. In addition, provide the following:
- B. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
- C. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
  - 1. Inside receptacle box at the work area.
  - 2. Behind the communication closet patch panel or punch block.
- D. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.
- E. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606 standard color codes for termination blocks.
- F. Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
- G. Label cables, outlets and patch panels with prefix (D=Data and V=Video) and room number in which outlet is located, followed by a single letter suffix to indicate particular outlet within room, i.e., D107A, D107B, V107. Indicate riser cables by an R then pair or cable number.
- H. Fiber optic labels shall be securely fastened to innerduct and fiber optic cables at all pullboxes, manholes, termination points and splice points.

- I. Fiber optic labels shall be plastic laminate with engraved letters of ¼ inch minimum. Labels shall contain fiber type, size and destination.
- J. Each fiber strand and ST connector shall be labeled with a printed label corresponding to an identical label at opposite end.
- K. Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the owner two (2) weeks prior to move in to allow the owner's personnel to connect and test owner-provided equipment in a timely fashion. Obtain floor plans from Architect.
- L. Three (3) sets of as-built drawing shall be delivered to the owner within four (4) weeks of acceptance of project by the owner. A set of as-built drawings shall be provided to the owner in compact disc media form and utilizing CAD software that is acceptable to the owner. The compact disc media shall be delivered to the owner within six (6) weeks of acceptance of project by owner.

### 3.08 TESTING

#### A. Copper (UTP) Testing:

- 1. Testing of all data cabling shall be performed prior to system cutover. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Horizontal data cabling pairs shall be tested from the information outlet to the corresponding IDF point of termination.
- 2. Data cable runs shall be tested for conformance to the specifications of EIA/TIA 568B Category 6.
- 3. Test Equipment shall comply with TIA/EIA TSB-67 for level II, TIA/EIATSB-95 for Level IIE, and TIA/EIA 568A Level III Accuracy at basic link.
- 4. All Data Cables (And All Pairs) Shall Be Tested From Patch Panel to Jack and must measure network-specific channel response to provide accurate pass/fail for all major LAN networking standards.
- 5. Must be able to provide graphic reports with printouts of full plot data.
- 6. Complete, end to end test results must be submitted to the owner.

#### B. Optical Fiber Cable Testing:

- 1. Each fiber strand, including spare strands, shall be Optical Time Domain Reflectometer (OTDR) tested. Detailed testing specifications will be available after the bid award.
- 2. The OTDR used shall be equipped with suitable launch cables. The OTDR traces will accurately display dB loss per division and magnify to the largest scale possible, zooming in on the trace being monitored. The raw information that is gathered shall be compiled and displayed in a simple and useable manner. Test results shall be stored on a disk. Hard copy, printed results showing bandwidth (design) and dB loss shall be submitted with documentation package.
- 3. Horizontal Link Measurement

- a. The horizontal link should be tested at 850 nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper. The attenuation results should be less than 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.

#### 4. Backbone Link Measurement

- a. The backbone optical fiber link segment will be tested in one direction at BOTH operating wavelengths to account for attenuation deltas associated with wavelength. Single-mode backbone links will be tested at 1310 nm and 1550 nm in accordance with ANSI/EIA/TIA-526-7, Method A.1, One Reference Jumper. 50/125 um backbone links will be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA -526-14A, Method A.1, One Reference Jumper.

5. Cables must pass all tests, for all stands, or shall be repaired or replaced.

#### C. Pre-installation Cable Testing:

1. The Contractor shall test all lightguide cable prior to the installation of the cable.
2. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.

### 3.09 FIELD QUALITY CONTROL

- A. Employ job superintendent, certified manufacturer of network switches and project manager during the course of the installation to provide coordination of work of this specification and of other related specifications, and provide technical information when requested by owner.

### 3.010 DOCUMENTATION

- A. Submit project record drawings at conclusion of the project and include:
  1. Approved shop drawings.
  2. Plan drawings indicating locations and identification of work area outlets, nodes, IDF and backbone (riser) cable runs.
  3. Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
  4. Labeling and administration documentation.
  5. Warranty documents for equipment.
  6. Copper certification test result printouts and loaded onto a USB thumb drive.
  7. Optical fiber power meter/light source test results.
  8. Operation and maintenance manuals

### 3.011 CLEANING

- A. On completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

### 3.012 TRAINING

- A. The contractor shall provide one (1) man for one (1) week (40 hours) at school beginning with the first scheduled move-in date. This technician will also assist the owner in cross connecting the security, VoIP Telephone, IP CCTV and data services throughout the buildings during the move-in period. It is at this time that all owners provided connectivity schedules for voice and data services will be provided to the contractor. Patching (cross connection) of the station assignments between the owners service demarc shall also be considered part of this contractors work.

END OF SECTION 272102



## SECTION 276600 – COMMUNICATIONS EQUIPMENT ROOMS AND FITTINGS

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.
- B. Telecommunications Rooms (MDF/IDF) are generally considered to be floor serving facilities. Horizontal Cross-connects link the Horizontal cable and the Backbone Cable together. The Horizontal Cross-connects shall consist of rack or wall mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect termination units or fiber management panels/trays for the termination of optical fibers. Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.

#### 1.2 SCOPE

- A. This section includes the minimum requirements for equipment, termination hardware and cable installations in communication equipment rooms.
- B. The telecommunications room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- C. Minimum composition requirements and installation methods for the following:
  - 1. Floor Mounted Relay Racks
  - 2. Wall Mounted Relay Racks and Brackets
  - 3. Floor Mounted Cabinets
  - 4. Cable Management Hardware
  - 5. Cable Ladder Rack (Provided by Electrical Contractor)
  - 6. Patch Panels - Category 6 - Voice
  - 7. Patch Panels - Category 6 - Data
  - 8. Fiber optic panels - Wall Mount Box
  - 9. Fiber optic panels - rack mount (low fiber count)
  - 10. Fiber optic panels/frames- rack mount (moderate fiber count)
  - 11. Fiber optic frames - rack mount (high fiber count)
  - 12. Fiber optic trays - rack mount
  - 13. Back Boards
  - 14. 66 System Blocks
  - 15. Cross Connect Wire
  - 16. Power Strips
  - 17. Optical Fiber Patch Cords
  - 18. Patch Cords - UTP Category 6 - Voice
  - 19. Patch Cords - UTP Category 6 - Data
  - 20. 66 System Patch Cords - Category 6 – Voice
  - 22. Uninterruptable Power Supplies (UPS)

#### 1.3 QUALITY ASSURANCE

- A. All equipment rooms shall be installed in a neat and workmanlike manner.

- B. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Authority's representative.
- C. Equipment and materials shall be of the quality and Manufacturer indicated.
- D. The equipment specified is based on the acceptable manufacturers listed.
- E. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.
- F. Separation from sources of EMI shall be as specified in section.
- G. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
- H. Materials and work specified herein shall comply with the applicable requirements of:
  - 1. EIA/TIA-568-A.
  - 2. EIA/TIA-569-A
  - 3. EIA/TIA-606
  - 4. EIA/TIA-607
  - 5. Underwriters Laboratory
  - 6. Federal Communications Commission (including CFR 47 and Part 68 - subpart F)
  - 7. National Electric Code
  - 8. Local and State Codes
  - 9. ISO/IEC 11801
  - 10. IEC 1000-5-2
  - 11. CSA C22.2
  - 12. IEC 60603-7
- I. Manufacturers shall be ISO 9001 Certified, for all components that are required to have submittals provided as part of this section.

## PART 2 – PRODUCTS

### 2.1 FLOOR MOUNTED RELAY RACKS

- A. Racks shall meet the following physical specifications:
  - 1. 19" rack mounting space.
  - 2. 7 foot high.
  - 3. Lightweight, high strength aluminum construction.
  - 4. Black powder coat finish.
  - 5. 15" deep base with four (4) ¾" bolt down holes.
  - 6. EIA Channel width of 3.0", with #12-24 screw holes
- B. Rack shall have double sided 12/24 tapped holes and EIA universal rack 5/8" to 5/8"- 1/2" standard hole pattern (compatible with 1 1/4" – 1/2" hole patterns)



## 2.2 WALL MOUNTED RELAY RACKS

- A. Wall Mounted Relay Racks shall be provided in locations designated on the drawings and shall meet the following physical specifications:
  - 1. 19" EIA rack mounting space.
  - 2. 48" high with 24 mounting spaces.
  - 3. Lightweight, high strength steel construction.
  - 4. Black powder coat finish.
  - 5. Stationary mounting with 21" deep, 14 gauge mounting brackets and 100 lb. capacity.
  - 6. Racks shall have double sides EIA universal rack 5/8" to 5/8" - 1/2" standard hole pattern (compatible with 1 1/4" - 1/2" hole patterns)

## 2.3 FLOOR MOUNTED CABINET

- A. Floor mounted cabinets shall meet the following specifications:
  - 1. 16 gauge steel construction
  - 2. Nominal 77"x21"x36"
  - 3. Vented roof
  - 4. Removable side panels.
  - 5. Leveling feet

## 2.4 CABLE MANAGEMENT FOR RELAY RACKS

- A. Cable management shall be black metal with integral wire retaining fingers.
- B. Vertical cable management panels shall have front and rear channels.
- C. Vertical cable management panels shall have removable front and back covers, made of black metal.
- D. A horizontal crossover cable manager shall be provided at the top of each relay rack, with a minimum height of 2 rack units each.
- E. A horizontal crossover cable manager shall be provided near the center and at the bottom of each relay rack, with a minimum height of 4 rack units.

## 2.5 LADDER RACK

- A. Provide ladder rack in Telecommunications Room (MDF/IDF) as shown on drawings for horizontal cable support).

## 2.6 PATCH PANELS - CATEGORY 6 – VOICE

- A. The termination panels shall support the appropriate Category 6 applications and facilitate cross-connection and inter-connection using modular patch cords.
- B. Shall be sized to fit an EIA standard, 19-inch relay rack, or be capable of mounting to a wall.
- C. Accommodate at least 24 ports for each rack mount space (1rms = 44.5 mm [1.75 in.]).
- D. Have circuit boards tested in both directions as required by ANSI/TIA/EIA-568-A and ISO/IEC 11801.

- E. Have patented angle left/angle right modules to provide optimum cable management.
- F. Have removable six port modules to allow replacement in the field.
- G. Have Category 6 jacks available in both T568A and T568B wiring schemes, with 66-style termination.
- H. Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- I. Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro inches of gold plating over nickel contacts or equivalent.
- J. Allow the use of a 4 or 5-pair 66-style impact termination tool.
- K. Be fully enclosed front and provide rear plastic strips for physical for physical protection of printed circuit board.
- L. Have port identification numbers on both the front and rear of the panel.
- M. Provide clear label holders and white designation labels with the panel, with optional color labels available.
- N. Be made by an ISO 9001 Certified Manufacturer.
- O. ANSI/TIA/EIA-568-A and ISO/IEC 11801 proposed Category 6 compliant.
- P. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB

- Q. Be UL VERIFIED for TIA/EIA Category 6 electrical performance.
- R. Shall be UL Verified for Category 6 compliance and be CSA C22.2 approved.
- S. Be made of a steel frame with black power coat finish 24, 48, and 96 port configurations.
- T. Have mounting slots compatible with ANSI/EIA-310.
- U. Allows the modular insert to accept 66-style patch plugs as a means of termination.
- V. Shall be T-568A Wired.
- W. Provide 48 port panels, unless otherwise noted.
- X. Density must accommodate at least 24 port per single rack unit (1.75" or 44.5mm)
- Y. Paired punch down sequence to allow pair twist within ½" of the termination.

- Z. Shall have port identification numbers on front and rear of the panel.
- AA. Support applications up to 250 MHz
- BB. Have 66 style insulation displacement contacts and termination accomplished with a single conductor impact tool or 4 or 5 pair impact tool.
- CC. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
- DD. Have circuit identification and color-coding designation strips provided with the panel.
- EE. Provide port configurations and densities as called for on drawings.
- FF. Provide rear cable management bar(s) as recommended by the manufacturer.
- GG. Shall be Insulation Displacement Connector 66 style terminations
- HH. Provide EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice or data functionality as required
- II. Paired punch down sequence to allow pair twist within ½” of the termination.
- JJ. Provide rear stress relief components as recommended by the manufacturer.
- KK. Acceptable Manufacturers
  - 1. Siemon
  - 2. Hubbell
  - 3. Panduit
  - 4. Or approved equal

## 2.7 PATCH PANELS - CATEGORY 6 – DATA

- A. The termination panels shall support the appropriate Category 6 applications and facilitate cross-connection and inter-connection using modular patch cords.
- B. Shall be sized to fit an EIA standard, 19-inch relay rack, or be capable of mounting to a wall.
- C. Be made of a steel frame with black power coat finish, in 24, 48, 72 and 96-port configurations.
- D. Accommodate at least 24 ports for each rack mount space (1rms = 44.5 mm [1.75 in.]).
- E. Have circuit boards tested in both directions as required by ANSI/TIA/EIA-568-A and ISO/IEC 11801.
- F. Have patented angle left/angle right modules to provide optimum cable management.
- G. Have removable six port modules to allow replacement in the field.
- H. Support applications up to 250 MHz
- I. Have Category 6 jacks available in both T568A and T568B wiring schemes, with 66-style termination.
- J. Have 66 style insulation displacement contacts and termination accomplished with a single

conductor impact tool or 4 or 5 pair impact tool.

- K. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
- L. Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- M. Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 microinches of gold plating over nickel contacts or equivalent.
- N. Allow the use of a 4 or 5-pair 66-style impact termination tool.
- O. Be fully enclosed front and provide rear plastic strips for physical protection of printed circuit board.
- P. Have port identification numbers on both the front and rear of the panel.
- Q. Provide clear label holders and white designation labels with the panel, with optional color labels available.
- R. Have circuit identification and color-coding designation strips provided with the panel.
- S. Be made by an ISO 9001 Certified Manufacturer.
- T. ANSI/TIA/EIA-568-A and ISO/IEC 11801 proposed Category 6 channel compliant.
- U. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB

- V. Be UL VERIFIED for TIA/EIA Category 6 electrical performance.
  - 1. Shall be UL Verified for Category 6 compliance and be CSA C22.2 approved.
  - 2. Provide EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice or data functionality as required.
  - 3. Provide 48 port panels, unless otherwise noted
- Z. Paired punch down sequence to allow pair twist within ½" of the termination.
- AA. Shall have port identification numbers on front and rear of the panel.
- BB. Density must accommodate at least 24 port per single rack unit (1.75" or 44.5mm)
- CC. Have mounting slots compatible with ANSI/EIA-310.
- DD. Allows the modular insert to accept 66-style patch plugs as a means of termination.
- EE. Shall be T-568A Wired.
- FF. Provide port configurations and densities as called for on drawings.

GG. Provide rear cable management bar(s) as recommended by the manufacturer.

HH. Shall be Insulation Displacement Connector 66 style terminations.

II. Provide rear stress relief components as recommended by the manufacturer.

JJ. Be UL verified for TIA/EIA Category 6 electrical performance.

KK. Acceptable Manufacturers:

1. Siemon
2. Hubbell
3. Panduit
4. Or approved equal

## 2.8 FIBER OPTIC PANELS - WALL MOUNT BOX

A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. The wall mount interconnect center shall:

1. Be available in 12,24 port termination densities for single door applications
2. Be available in 12,24 and 48 port termination densities for dual door applications
3. Accommodate various simplex connectors including ST®, SC, FC and LX.5
4. Have single or dual hinged doors.
5. Have the ability to mount the cable clamp on the interior of the panel
6. Feature adapters which are angled
7. Have radiused outer edges and be putty white in color
8. Offer factory termination of the optical cable as an option
9. Be made by an ISO 9001 certified manufacturer
10. Provide port configurations and densities as called for on drawings.

## 2.10 FIBER OPTIC PANELS - RACK mount (low fiber count)

A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. Shall be available in 12 and 24 port with no splicing.

C. Be available in 24 port configuration for splicing.

D. Allow mounting in either 19" or 23" equipment bays.

E. Allow flush or 5" recess mounting.

F. Use adapter plates that house 6 adapters each.

G. Have adapters angled to the left and right of the panel.

H. Be available in black.

I. Be made by an ISO 9001 certified manufacturer.

- J. Shall meet or exceed all TSB-72 requirements.
- K. Provide port configurations and densities as called for on drawings.
- L. Shall be wall or rack mountable.
- M. Shall have a hinged removable front cover.
- N. Shall feature a front access design with a hinged bulkhead plate.
- O. Shall house 6 adapters per adapter plate.

#### 2.11 FIBER OPTIC PANELS/FRAMES - RACK MOUNT (MODERATE FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in 12, 24, 48, 72 and 96 port configurations.
- C. Feature a front access design with hinged bulkhead plate.
- D. Use adapter plates that house 6 adapters each.
- E. Have a hinged removable front cover.
- F. Have adapters that are angled to the left of the panel.
- G. Have an integrated vertical cableway on one side of the panel.
- H. Be mountable in flush, 1"2" and 5" recess options.
- I. Be 19" and 23" rack mountable.
- J. Have storage and splicing options as part of the product offering.
- K. Support the addition of optical components such as WDM's and splitters to the product offering.
- L. Be available in putty.
- M. Be made by an ISO 9001 certified manufacturer.
- N. Provide port configurations and densities as called for on drawings.

#### 2.12 FIBER OPTIC FRAMES - RACK MOUNT (HIGH FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in putty, and made of 12-gauge aluminum alloy.
- C. Available in up to 24, 32, 48, and 72 port versions with ST® fiber adapters preloaded into adapter plates or 48, 64, 96 and 144 port versions using quad SC fiber adapters preloaded into adapter plates.
- D. Have preloaded adapter plates with SC, ST®, or LX.5 fiber adapters in 6 and 8 port versions as well as a 12 port version for the SC adapter.

- E. Have blank adapter plates for future growth of the fiber infrastructure.
- F. Have fiber managers to effectively store fiber cable slack and comply with fiber bend radius requirements.
- G. Have six and eight port fiber adapter plates, which allow for color coding connectors.
- H. Have fiber adapter plates with snap-in installation.
- I. Accommodate stackable splice trays, each tray manages a total of 24 splices.
- J. Have an adapter plate-mounting bracket, which slides out to the front and to the rear of the unit for increased access.
- K. Have cable access points for fiber jumpers entering and exiting the unit with rotating grommets to facilitate cable loading and to minimize micro bending stress.
- L. Have anchor points for fiber cable(s) entering the unit.
- M. Have labeling which meets or exceed ANSI/TIA/EIA-606 requirements and also be laser printable.
- N. Be able to mount both 19-inch and 23-inch rack/cabinets.
- O. Be UL C22.2 approved.
- P. Be made by an ISO 9001 Certified Manufacturer.
- Q. Provide port configurations and densities as called for on drawings.

#### 2.13 FIBER OPTIC FRAMES - (HIGH FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in 72 and 96 port configurations.
- C. Feature termination panels with individual adapter retainers.
- D. Feature termination panels with angled adapter retainers with ½ the panel angled to the left and ½ the panel to the right.
- E. Have various termination, splice and storage units available that can be mixed and matched within a common frame.
- F. Support termination densities up to 864 per frame.
- G. Offer connector styles of SC, FC, ST® and LX.5.
- H. Be made by an ISO 9001 certified manufacturer.
- I. Provide port configurations and densities as called for on drawings.

#### 2.14 FIBER OPTIC TRAYS - RACK MOUNT

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. Rack-Mounted Fiber Tray

C. The rack mounted fiber tray shall:

1. Be made of 18-gauge steel with a black finish.
2. Available in 16-, 24-, 28-, 32- and 48-port configurations, and be able to double that port count utilizing 6-port adapters.
3. Accommodate SC, ST®, and LX.5 adapters.
4. Accommodate hybrid adapter bezels for ST®-to-SC or SC-to-ST® connections.
5. Have changeable ports, which are removed from the front of the unit to allow custom configuration or modification.
6. Have silk-screened port identification numbers provided on both the front and rear of the panel.
7. Include fiber managers that manage slack storage so as to comply with fiber bend radius requirements and slack storage length recommendations.
8. Accommodate stackable splice trays, which manage up to 24 splices per tray.
9. Have a smoked polycarbonate cover with quarter turn screws for easy access.
10. Not exceed a 254 mm (10 in) depth for mounting in standard cabinets and enclosures.
11. Be provided with strain relief lugs for the fiber cable entering the unit from the side or back.
12. Be made by an ISO 9001 Certified Manufacturer.
13. Provide port configurations and densities as called for on drawings.

2.15 BACKBOARDS

- A. Shall be 4 x 8 x ¾" ACX or BCX, exterior grade, fire rated plywood.
- B. Shall be painted – gray, acrylic, interior, fire retardant paint.
- C. Provide adequate support and dress horizontal cabling between ladder rack and 66 wiring blocks as necessary or as shown on the drawings. Review cable routing plan for the Telecommunications Rooms, in the field, before installation of cabling commences.

2.16 MODULAR 66M SYSTEM BLOCKS

- A. The connecting hardware block shall support the appropriate Category 6, applications and facilitate cross-connection and/or inter-connection using either approved cross-connect wire or patch cords.
- B. Shall be modular 66M System IDC style blocks.
- C. Be UL VERIFIED or equivalent for TIA/EIA proposed Category electrical performance.
- D. Be ANSI/TIA/EIA-568-A and ISO/IEC 11801 Category 6 compliant.
- E. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB



- F. Be UL VERIFIED or equivalent for TIA/EIA proposed Category electrical performance.
- G. Be CSA C22.2 approved or equivalent.
- H. Be made of flame-retardant thermoplastic.
- I. Be available in 50-, 100-, and 300-pair sizes.
- J. Have 50-, 100, - and 300 pair blocks available without legs while the 100, and 300 pair blocks are available without legs.
- K. Blocks shall include means to identify cables/services per ANSI/TIA/EIA-606.
- L. Have clear label holders with the appropriate colored inserts available for the wiring blocks. The insert labels provided with the product shall contain vertical lines spaced on the basis of circuit size (3-, 4- or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords. Label holders must be capable of mounting in the under portion of the wiring block.
- M. Have connecting blocks used for either the termination of cross-connect (jumper) wire or patch cords. The connecting blocks shall be available in 3-, 4- and 5-pair sizes. All connecting blocks shall have color-coded tip and ring designation markers and be of single piece construction.
- N. Have connecting blocks with a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- O. Support wire sizes: Solid 22-26 AWG (0.64 mm - 0.40 mm), and 7-strand wires.
- P. Be made by an ISO 9001 Certified Manufacturer.
- Q. Shall be 300 pair blocks, typical for feed and station cable, unless otherwise noted.
- R. Provide keep-off indicator buttons on all active cross-connected pairs used for alarm and security purposes. Coordinate the color and use with the Authority's representative.
- S. Provide connecting block designation label strips of the colors conforming to EIA/TIA 606, including but not limited to the following:

## 2.17 CROSS CONNECT

- A. Provide modular 66M cross connect blocks for all backbone terminations.
- B. Cross-connects shall be made with wire of equal gauge to that of the feed cable, which it is being connected to.
- C. Shall be UL listed
- D. Provide (1) roll of 1 pair and (1) roll of 2 pair per Telecommunications Room (TR). Coordinate color code of one and two pair with the Authority's representative.

## 2.18 POWER STRIP

- A. Shall be 20 amp, 115V.
- B. Shall be rack mounted.
- C. Shall be non-switched.

- D. Shall provide a minimum of one power strip per rack that contains active electronics, or as detailed on the drawings.
- E. Shall be surge suppressed.
- F. Shall have a minimum of 6 outlets – transformer spaced where possible.
- G. Must have 20 amp twist lock plug.
- H. Shall have a 10' cord, minimum.
- I. Shall be UL listed and must meet UL 1363 and 1449 requirements.

#### 2.19 OPTICAL FIBER PATCH CORDS - Multimode

- A. Shall be available in standard lengths of 1, 3, and 5 meters, custom lengths shall also be available, and shall meet or exceed standards as defined in ANSI/TIA/EIA-568-A and ISO/IEC 11801.
- B. Utilize duplex optical fiber cable that is 62.5/125 or 50/125 micron multimode, OFNR riser grade, and meets the requirements of UL 1666.
- C. Utilize optical fiber cable where the attenuation shall not exceed 3.5 dB/km @ 850 nm wavelength or 1.0 dB/km @ 1300 nm.
- D. Have a cable jacket color for 62.5/125 in gray and 50/125 in orange.
- E. Be equipped with SC or ST® in accordance with TIA/EIA-568-A and must include a ceramic ferrule.
- F. Have ST® connectors with a metal coupling nut.
- G. Have terminated connectors exhibit a maximum insertion loss of 0.75 dB with an average of 0.40dB when tested at either 850 nm or 1300 nm wavelengths for 62.5/125 □m.
- H. Have terminated connectors exhibit a maximum insertion loss of 0.75 dB with an average of 0.50dB when tested at either 850 nm or 1300 nm wavelengths for 50/125 □m.
- I. Have a minimum return loss of 20 dB (25 dB typical) at both 850 nm & 1300 nm.
- J. Be made by an ISO 9001 Certified Manufacturer.
- K. Be UL 1666 approved.
- L. Shall be a duplex fiber cable meeting or exceeding the transmission characteristics of the optical fiber horizontal cable.
- M. Connectors shall be either LX.5 or duplex T568SC, as specified on the drawings or equipment schedules.
- N. Jackets shall be orange in color for multi-mode connections and yellow for single mode connections.
- O. The following configurations may be required:

1. ST/ST
2. SC/SC
3. LX.5/LX.5
4. ST/SC
5. SC/LX.5
6. ST/LX.5

## 2.20 CATEGORY 6 PATCH CORDS - MATCH COLOR OF VOICE CABLES

- A. Shall be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.
- B. Be equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.
- C. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 microinches minimum of gold plating over nickel contacts.
- D. Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.
- E. Utilize cable that exhibits power sum NEXT performance.
- F. Be available in several colors with or without color strain relief boots providing snagless design.
- G. Meet the flex test requirements of 1000 cycles with boots and 100 cycles without boots.
- H. Be available in any custom length and standard lengths of meters (3, 5, 7, 10, 15, 20, and 25 feet).
- I. Be made by an ISO 9001 Certified Manufacturer.
- J. Electrical Specifications:
  1. Input impedance without averaging 100 + 15% from 1 to 100 MHz.
  2. 100% transmission tested for performance up to 100 MHz. Manufacturer shall guarantee cords are compatible with Category 6 links.
  3. Utilize cable that is UL VERIFIED (or equivalent) for TIA/EIA proposed Category 6 electrical performance.
  4. UL LISTED 1863.

## 2.21 CATEGORY 6 PATCH CORDS - MATCH COLOR OF DATA CABLE

- A. Shall be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.
- B. Be equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.
- C. Be backwards compatible with lower performing categories.
- D. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 microinches minimum of gold plating over nickel contacts.
- E. Have matching color strain relief boot with a snagless design which shall meet the flex testing as called out in 1000 cycles with boots and 100 cycles without boots.

- F. Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.
- G. Utilize cable that exhibits power sum NEXT performance.
- H. Be available in any custom length and standard lengths of (3, 5, 7, 10, 15, 20, and 25 feet).
- I. Be made by an ISO 9001 Certified Manufacturer.
- J. Electrical Specifications:
  - 1. Have input impedance without averaging: 100 + 15% from 1 to 100 MHz, + 22% from 100 to 200 MHz and + 32% from 200 to 250 MHz.
  - 2. Be 100% transmission tested for performance up to 250 MHz. Manufacturer shall guarantee cords are compatible with proposed Cat-6 links.
  - 3. Utilize cable that is UL VERIFIED (or equivalent) for TIA/EIA proposed Category 6 electrical performance.
  - 4. Be UL LISTED 1863.

## 2.23 UNINTERUPPTABLE POWER SUPPLY (UPS)

- A. Input and Output connections of the UPS units shall be configured in accordance with the devices the unit is intended to power.
- B. Individual UPS units shall be sized to provided two (2) hours of operation for the equipment it powers.
- C. UPS units shall comply with the following specification:
  - 1. Waveform Type shall be sine wave.
  - 2. Battery Type Sealed Lead-Acid battery
  - 3. Interface Port: DB9, RS232
  - 4. Mgmt. Software Windows based with Server Shut down
  - 5. Rack Mounted.
  - 6. Acceptable Manufacturers:
    - a. APC
    - b. Tripp Lite
    - c. Best Power
    - e. Or approved equal

## PART 3 - EXECUTION

### 3.1 FLOOR MOUNTED RELAY RACKS

- A. All racks shall be anchored to the floor.
- B. Provide vertical and horizontal cable as shown on drawing.
- C. Mount with a minimum of 36" feet clear access behind and front of rack from the wall to a rack.
- D. Ground the rack to the equipment ground bar with a #6 copper wire.
- E. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.

### 3.2 WALL MOUNTED RELAY RACKS

- A. Secure Wall Mounted Relay Racks to building structure with approved anchoring means.
- B. Verify all existing wall construction and submit proposed anchoring methods for approval.
- C. Provide vertical and horizontal cable management both front and rear wherever available.

### 3.3 LADDER RACK

- A. Ladder Rack shall be secured to walls and top of equipment rack.
- B. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.

### 3.4 CABLE MANAGEMENT

- A. Provide horizontal and vertical cable management in each cabinet; with horizontal cable management between each piece of electronics.
- B. A horizontal crossover cable manager shall be provided at the top and bottom of each relay rack, with a minimum height of 2 rack units each.
- C. A horizontal crossover cable manager shall be provided near the center of each relay rack, with a minimum height of 4 rack units.
- D. Provide two rear cable management bars and reusable Velcro-type hook and loop straps in each rear vertical channel. Reusable straps shall be of varying sizes (each allowing 50% spare future expansion) and of adequate quantity to secure cable bundles at least every 4 rack units.
- E. Secure cable managers, slack managers, support bars, hook and loop straps per manufacturer recommendations.

### 3.5 CATEGORY 6 PATCH PANELS – VOICE

- A. Install and label as recommended by manufacturer per all EIA/TIA 606.
- B. Install rear cable management bar(s) as recommended by manufacturer.
- C. Install EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice functionality.

### 3.6 CATEGORY 6 PATCH PANELS – DATA

- A. Install and label as recommended by manufacturer, per all EIA/TIA 606.
- B. Install rear cable management bar(s) as recommended by manufacturer.
- C. Install EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify Data functionality.

### 3.7 OPTICAL FIBER PATCH PANELS

- A. Install as shown on drawings.

- B. Furnish and Install labels for each strand, as per the Authority's instruction in the field or as shown on drawings.
- C. Install blank adapter panels in all positions not used at time of installation for fiber terminations.

### 3.8 CABLE SUPPORTS

- A. Provide "D" rings on 2 ft. center for all exposed wall mounted vertical Category 6 cable runs.
- B. Keep horizontal wall mounted cable runs to a minimum. In general, horizontal runs shall be on wall mounted ladder rack.
- C. Provide cable brackets 3' on center supported to building structure for all cable runs not supported by cable tray.

### 3.9 BACKBOARDS

- A. Linear wall space used for anchoring equipment shall be lined for the full room width with plywood, per the drawings.
- B. Plywood for mounting termination equipment on shall be installed vertically, side by each, a minimum of 6" above finished floor. Mounting shall be sufficient enough to support the equipment.
- C. Plywood for supporting backbone riser cables shall be installed vertically, resting directly on the finished floor. Anchoring and mounting techniques of plywood used to support backbone riser cables shall be sufficient to support a minimum of 1000 pounds of weight.
- D. In no cases shall the heads of mounting screws protrude past the face of any plywood.
- E. Install distribution rings for the cross-connect fields above all wall mounted blocks. Two rings per vertical row of blocks. Mount rings with two hex head screws per ring.

### 3.10 MISCELLANEOUS REQUIREMENTS

- A. All cables shall be neatly "dressed out" in equipment rooms.
- B. Provide service loops on all cables terminated in the telecommunications rooms, per the drawings.
- C. Firestop all sleeves and conduits openings after the cable installation is complete.

### 3.11 MODULAT 66M SYSTEM BLOCKS

- A. Installed on plywood backboard so that top of 300 pair block is 5'6" AFF, or as noted on the drawing.
- B. Mount Blocks with steel, zinc plated 5/16" slotted hex head #10 x 3/4" drill screws, minimum four screws per block.
- C. Install designation strips color-coded in conformance with EIA/TIA 606 standard.
- D. Install insulator clips (sometimes called keep-offs) on all Life and Safety special circuits in the Telecommunications Rooms (MDF/IDF), coordinate desired color code requirements with the Authority's representative.

END OF SECTION 276600

## SECTION 280000 – ELECTRONIC SAFETY AND SECURITY

### PART 1 – GENERAL

#### 1.1 GENERAL

- A. The purpose of this specification is to describe the requirements for the Security Systems for the Fair Lawn BOE SCHOOL. The following systems shall be provided and installed;
1. IP PoE Surveillance CCTV System will be utilized for monitoring the outside perimeters of the School, to include building approaches, parking lots, and playgrounds/athletic fields. The system will also monitor the main access into the building for visitor identification. The system will operate locally and will also allow for remote access over the Authority's WAN by authorized users. The IP PoE Surveillance CCTV System Network shall have cabling infrastructure and switch fabric dedicated to the application. This specification includes a video surveillance system consisting of the following:
    - a. Network Video HD Recorder (NVR) and Software
    - b. IP PoE cameras
    - c. Data transmission wiring
    - d. Control station with its associated equipment (PC and LCD Flat Panel Monitors).
  2. Access Control System that shall electronically control the entrance/egress patterns of the building with equipment to lock/unlock doors based on preset and programmable building management criteria. The System will allow for door access by authorized users, utilizing card access technology. The System shall be comprised of the following:
    - a. Central Monitoring System
    - b. Proximity Type Access Card Reader (CR)
    - c. Electric Strike (ES)
    - d. Mechanical Panic Bars (P) and Electrical Panic Bars (PE)
    - e. Motion Detectors (MD)
    - f. System wiring infrastructure
  3. Intrusion Alarm System will provide intrusion detection for designated doors and windows with hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions. Intrusion sensors shall not be wired in series. The System shall include the following:
    - a. Alarm Control Panels and keypads
    - b. Magnetic Door Contacts on all ground level exterior doors
    - c. Acoustical Glass Break Detectors in all ground level rooms with windows
    - d. Magnetic Contacts on all ground level operable windows
    - e. Dual Motion Detectors in all ground level rooms with windows
    - f. System wiring infrastructure
  4. A Video-Intercom Entry System installed at the main entrance and the exterior door of the Cafeteria Kitchen (for deliveries) which will allow visitors to request entry to the building. Telecommunications voice grade cable infrastructure shall be utilized to support the intercom system to provide Door Station to Master

Station communications.

- a. The system shall enable staff to communicate directly with visitors, and permit visitors entrance into the facility via a door release system which will be controlled via remote devices such as door strikes from strategic locations within the building.
  - b. A visitor would be able to call the Master Station intercom via a call button to gain access through a locked door. The staff would be able to verify the identity of the visitor via two-way verbal communication in conjunction with a visual verification provided by the video image and grant access to the visitor by pressing a key on the intercom Master Station. The Master Station will control all the remote intercom and door release functions.
5. There will be a Security Key in a secured lock box (Knox Box) for Fire personnel access into the building in case of an emergency, located at the main entrance. The box shall be interfaced with the Intrusion Alarm System to detect tampering.

1.2 TESTING, IDENTIFICATION AND ADMINISTRATION

- A. The Authority may use any operating portion of the system prior to Acceptance.
- B. Acceptance is defined as a satisfactory compliance with these specifications as determined by the Design Consultant.
- C. The Contractor shall test the Security Systems connections to insure that all features specified in Division 28 are operational and working properly.
- D. Contractor will insure that all Access Security and Surveillance CCTV equipment outlets, cable pairs are properly identified in accordance with TIA/EIA-606.
- E. Furnish electronic record of all drawings, in software and format selected by the Authority.
- F. Furnish Three (3) copies of Hardware and Software documentation to the Authority and Design Consultant.

1.3 CUTOVER AND TRAINING

- A. The Contractor shall test all features upon cutover.
- B. System Cut over shall not constitute acceptance or start of "Service" period.
- C. The Contractor will provide Seven (7) day notice to the Authority and Design Consultant prior to Cutover.
- D. Prior to Cutover, the Authority and Design Consultant will do a walkthrough of the building to ensure that all Access Security and Surveillance CCTV outlets and hardware are placed in correct locations and equipment is installed properly.
- E. The Authority and Design Consultant will review cable plant with Contractor to insure proper installation. Contractor will provide training to the Authority maintenance staff and user training.
- F. During Maintenance period, Contractor will provide training to the Authority for any new Software or System upgrades.



- G. Cutover will take place during normal working hours.
- H. The VENDOR shall train the Authority's maintenance personnel to adjust, operate, and maintain Access Security and Surveillance CCTV Systems equipment.
  - 1. Train the Authority's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
  - 2. For the first year, after the initial the Authority's training the Vendor will provide up to three (3) training sessions for maintenance personnel upon the request of the Authority.
  - 3. The Vendor will provide at a minimum three (3) user-training sessions. These sessions shall be coordinated with the Authority Technology Manager and School Principal's office.
  - 4. Scheduling of training and attendance will be coordinated with Authority Technology Manager and School Principal's office.

END OF SECTION 280000



## SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceways and cables.
  - 2. Sleeve seals.
  - 3. Grout.
  - 4. Common electronic safety and security installation requirements.

#### 1.2 SUBMITTALS

- A. Product Data: For sleeve seals.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

#### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Nelson

- b. Hilti
  - c. Specified Technologies, Inc.
  - d. Metraflex Co.
  - e. Pipeline Seal and Insulator, Inc.
  - f. Or Approved Equal
- 3. Sealing Elements: interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 4. Pressure Plates: Include two for each sealing element.
  - 5. Connecting Bolts and Nuts: of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 3 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 280500



## SECTION 280513 – CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Coaxial cabling.
2. RS-232 cabling.
3. RS-485 cabling.
4. Low-voltage control cabling.
5. Control-circuit conductors.
6. Fire alarm wire and cable.
7. Identification products.

#### 1.2 SUBMITTALS

##### A. Product Data: For each type of product indicated.

1. For coaxial cable, include the following installation data for each type used:

- a. Nominal OD.
- b. Minimum bending radius.
- c. Maximum pulling tension.

##### B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

##### C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

##### D. Source quality-control reports.

##### E. Field quality-control reports.

##### F. Maintenance data.

#### 1.3 QUALITY ASSURANCE

##### A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

##### B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Cable Trays:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cablofil Inc.
    - b. Cooper B-Line, Inc.
    - c. Chatsworth Products Inc.
    - d. Or Approved Equal
  - 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.
    - a. Basket Cable Trays: 6 inches wide and 2 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches.
    - b. Trough Cable Trays: 6 inches wide.
    - c. Ladder Cable Trays: 18 inches wide, and a rung spacing of 12 inches.
    - d. Channel Cable Trays: One-piece construction, 4 inches wide. Slot spacing shall not exceed 4-1/2 inches o.c.
    - e. Solid-Bottom Cable Trays: One-piece construction, 12 inches wide. Provide with solid covers.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

### 2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

### 2.3 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Superior Essex
  - 2. Belden CDT Inc.; Electronics Division.
  - 3. CommScope, Inc.



4. Or Approved Equal
- B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
  1. No. 14 AWG, solid, copper-covered steel conductor.
  2. Gas-injected, foam-PE insulation.
  3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
  4. Jacketed with sunlight-resistant, black PVC or PE.
  5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
  1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
  2. Gas-injected, foam-PE insulation.
  3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
  4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.
  1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
  2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
  3. Jacketed with black PVC or PE.
  4. Suitable for indoor installations.
- F. RG59/U: NFPA 70, Type CATV.
  1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
  2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
  3. PVC jacket.
- G. RG59/U (Plenum Rated): NFPA 70, Type CMP.
  1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
  2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
  3. Copolymer jacket.
- H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
  1. CATV Cable: Type CATV.
  2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
  3. CATV Riser Rated: Type CATVR, complying with UL 1666.
  4. CATV Limited Rating: Type CATVX.

## 2.4 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Leviton Voice & Data Division.
  - 2. Superior Essex.
  - 3. Or Approved Equal.
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

## 2.5 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Polypropylene insulation.
  - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
  - 4. PVC jacket.
  - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  - 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Type Cable: NFPA 70, Type CMP.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Plastic insulation.
  - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
  - 4. Plastic jacket.
  - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  - 6. Flame Resistance: Comply with NFPA 262.

## 2.6 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM[ **or CMG**].
  - 1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Type Cable: NFPA 70, Type CMP.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Fluorinated ethylene propylene insulation.
  - 3. Unshielded.
  - 4. Fluorinated ethylene propylene jacket.
  - 5. Flame Resistance: NFPA 262, Flame Test.

## 2.7 LOW-VOLTAGE CONTROL CABLE

- A. Paired Lock Cable: NFPA 70, Type CMG.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Type, Paired Lock Cable: NFPA 70, Type CMP.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.
- C. Paired Lock Cable: NFPA 70, Type CMG.
  - 1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Type, Paired Lock Cable: NFPA 70, Type CMP.
  - 1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  - 2. Fluorinated ethylene propylene insulation.
  - 3. Unshielded.
  - 4. Plastic jacket.
  - 5. Flame Resistance: NFPA 262, Flame Test.

## 2.8 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, power-limited cable, concealed in building finishes complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

## 2.9 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden
  - 2. Genesis Cable Products; Honeywell International, Inc.
  - 3. West Penn Wire/CDT; a division of Cable Design Technologies.

- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG or size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
  - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

## 2.10 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation
  - 2. Leviton
  - 3. Panduit Corp.
  - 4. Or Approved Equal
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

## 2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets or terminals.
  - 2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.
  - 3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
  - 4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 5. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 6. Pulling Cable: Do not exceed manufacturer's instructions as to allowable pulling tension. Monitor cable pull tensions.
- C. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

E. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

### 3.3 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
  - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### 3.5 CONNECTIONS

- A. Comply with requirements in Division 28 Section "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.
- D. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.
- E. Comply with requirements in Division 28 Section "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.
- F. Comply with requirements in Division 28 Section "Fire Detection and Alarm" for connecting, terminating, and identifying wires and cables.
- G. Comply with requirements in Division 28 Section "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.

### 3.6 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.7 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.8 IDENTIFICATION

- A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.9 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding.
  - 2. Visually inspect cable placement, cable termination, grounding, and bonding.
  - 3. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. Prepare test and inspection reports.

END OF SECTION 280513



## SECTION 280528 – PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface pathways.
4. Boxes, enclosures, and cabinets.

#### 1.2 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

##### A. Acceptable Manufacturers:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Alpha Wire Company.
4. Anamet Electrical, Inc.
5. Electri-Flex Company.
6. O-Z/Gedney; a brand of EGS Electrical Group.
7. Picoma Industries; Subsidiary of Mueller Water Products, Inc.
8. Republic Conduit.
9. Robroy Industries
10. Southwire Company.
11. Thomas & Betts Corporation.
12. Western Tube and Conduit Corporation.
13. Wheatland Tube Company; a division of John Maneely Company.
14. Or approved equal.

##### B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit IMC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Setscrew.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Acceptable Manufacturers:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman; a Pentair company.
  - 3. Mono-Systems, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or approved equal.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Finish: Manufacturer's standard enamel finish.

## 2.3 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Comply with TIA-569-B.
- B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Design Consultant or Prime coated, ready for field painting.
1. Acceptable Manufacturers:
    - a. Mono-Systems, Inc.
    - b. Niedax-Kleinhuis USA, Inc.
    - c. Panduit Corp.
    - d. Wiremold / Legrand.
    - e. Or approved equal.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Acceptable Manufacturers:
1. Adalet.
  2. Cooper Technologies Company; Cooper Crouse-Hinds.
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. Hoffman; a Pentair company.
  6. Hubbell Incorporated; Killark Division.
  7. Lamson & Sessions; Carlon Electrical Products.
  8. Milbank Manufacturing Co.
  9. Molex, Woodhead Brand
  10. Mono-Systems, Inc.
  11. O-Z/Gedney; a brand of EGS Electrical Group.
  12. RACO; a Hubbell Company.
  13. Robroy Industries.
  14. Spring City Electrical Manufacturing Company.
  15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
  16. Thomas & Betts Corporation.
  17. Wiremold / Legrand.
  18. Or approved equal.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-B.
  2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- E. Device Box Dimensions: 4-inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- F. Gangable boxes are allowed.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: Wiremold surface mounted raceway in finished areas. EMT in utility spaces.
  - 2. Exposed and Subject to Physical Damage: Wiremold surface mounted raceway in finished areas. EMT in utility spaces.
    - a. Loading dock.
    - b. Mechanical rooms.
    - c. Gymnasiums
    - d. Locker Rooms
  - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 4. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable pathway.
  - 5. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, communications-cable pathway.
  - 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Pathway Size: 1/2-inch trade size.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Pathways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Design Consultant for each specific location.
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
  - 1. Install surface pathway for surface electrical outlet boxes only where approved in field.
  - 2. Install surface pathway with a minimum 2-inch radius control at bend points.

3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
  1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service pathway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### 3.3 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 7.

### 3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 280528

## SECTION 283101 – FIRE ALARM SYSTEM

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
  - 1. 260501 Basic Electrical Materials and Methods
  - 2. 260524 Electrical Identification
- C. The system and all associated operations shall be in accordance with the following:
  - 1. Requirements of the following Model Building Code: IBC 2015 Edition
  - 2. Requirements of the following Model Fire Code: IFC 2015 Edition
  - 3. Requirements of the following Model Mechanical Code: IMC 2015 Edition
  - 4. NFPA 72, National Fire Alarm Code, 2016 Edition
  - 5. NFPA 70, National Electrical Code, 2014 Edition
  - 6. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2015 Edition
  - 7. ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, 2013 Edition
  - 8. Local Jurisdictional Adopted Codes and Standards
  - 9. ADA Accessibility Guidelines

#### 1.02 APPLICABLE STANDARDS

- A. All equipment shall be UL listed for its intended use and conform to the latest UL Standards.
  - B. Underwriters Laboratories Inc.: The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
    - UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
    - UL 268 Smoke Detectors for Fire Protective Signaling Systems.
    - UL 268A Smoke Detectors for Duct Applications.
    - UL 217 Smoke Detectors Single Station.
    - UL 521 Heat Detectors for Fire Protective Signaling Systems.
    - UL 228 Door Holders for Fire Protective Signaling Systems.
    - UL 464 Audible Signaling Appliances.
    - UL 1638 Visual Signaling Appliances.
    - UL 38 Manually Activated Signaling Boxes.
    - UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
    - UL 1971 Standard for Signaling Devices for the Hearing Impaired
    - UL 1481 Power Supplies for Fire Protective Signaling Systems.
    - UL 1711 Amplifiers for Fire Protective Signaling Systems.
- UUKL The Fire Alarm system shall be UUKL for Smoke Control.

### 1.03 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm system detection and notification operations.
  - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, and other equipment as indicated in the drawings and specifications.
  - 3. One-way supervised automatic voice alarm operations.
- D. The requirements of the Contract Documents, including the General and Supplementary General Condition and Division I - General Requirements shall apply to the work of this section.
- E. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, 2 weeks prior to the bid, provide a line by line specification comparison, listing any and all exceptions taken to these Specifications, along with the manufacturer's technical data sheets. All variances from these Specifications and all substitutions of operating capabilities must be forwarded to said Engineer. Any such exceptions, variances or substitutions that were not submitted and approved 2 weeks prior to the bid, shall be grounds for immediate disapproval without comment. Final determination of compliance with these Specifications shall rest with the Engineer, who, at his discretion, may require proof of performance.
- F. The entire system shall be installed with aesthetics in mind. All control panels and remote annunciators installed in public spaces shall be semi-flush mounted with no exposed conduit or cable trays.
- G. The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm system of the addressable, non-coded type. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer. The system shall consist of, but not be limited to, the following:
  - 1. Fire alarm Control Panel and related remote data gathering panels.
  - 2. Remote Annunciators with semi flush backbox.
  - 3. Addressable manual fire alarm stations.
  - 4. Addressable area smoke detectors.
  - 5. Addressable duct smoke detectors.
  - 6. Addressable carbon monoxide detectors.
  - 7. Addressable heat detectors.
  - 8. Magnetic door/card access release override control.



9. Audible notification appliances – Speakers.
10. Visual notification appliances – strobes.
11. Central station alarm Connection control.
12. Air handling systems shutdown control.
13. Magnetic door holder release.
14. Battery standby.
15. Digital alarm communicator transmitter.
16. System printer.

#### 1.04 DEFINITION

- A. ADA: Americans with Disabilities Act
- B. AHJ: Authority Having Jurisdiction
- C. ANSI: American National Standards Institute
- D. ASME: American Society of Mechanical Engineers
- E. FACP: Fire Alarm Control Panel
- F. FM: Factory Mutual
- G. IBC: International Building Code
- H. ICC: International Code Council
- I. IDC: Initiating Device Circuit
- J. IEEE: Institute of Electrical and Electronic Engineers
- K. IFC: International Fire Code
- L. IMC: International Mechanical Code
- M. IRI: Industrial Risk Insurers
- N. LED: Light-emitting diode.
- O. NAC: Notification Appliance Circuit
- P. NFPA: National Fire Protection Association
- Q. NICET: National Institute for Certification in Engineering Technologies.
- R. RAC: Releasing Appliance Circuit
- S. SLC: Signaling Line Circuit
- T. UL: Underwriters Laboratories
- U. ULC: Underwriters Laboratories, Canada

#### 1.05 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded addressable microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Power Requirements
  1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
  2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 48 hours with 10 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

3. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.
  4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
  5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
  6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
  7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
  8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.
1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
  2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
  3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave exec downloads.
  4. Remote panel site-specific software and executive firmware downloads shall be capable of being performed over proprietary fire alarm network communications.
  5. Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
  6. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.
  7. The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control unit.
- D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- E. Recording of Events: The system shall be capable of recording all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout shall differentiate alarm signals from all other printed indications.

F. Wiring/Signal Transmission:

1. Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.
2. System connections for initiating device circuits shall be Class B, Style D, signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
4. Constant Supervision Audio: When provided, audio notification appliance circuits shall be supervised during standby by monitoring for DC continuity to end-of-line resistors.

G. Supplemental Notification and Remote User Access (Fire Panel Internet Interface)

1. Fire Alarm Control Panel (FACP) shall provide the necessary hardware to provide supplemental notification and remote user access to the FACP using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
2. A standard RJ-45 Ethernet connection shall connect to the owner's Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
3. The means of providing supplemental email and SMS text messaging notification shall be agency listed for specific interfaces and for the purpose described in this section. The use of non-listed external third party products and interfaces is not acceptable.
4. The fire panel internet interface shall be capable of sending automated notification of discrete system events via email and SMS text messaging to up to 50 individual user accounts and via email to up to 5 distribution lists.
5. Each user account and distribution list shall be capable of being configurable for the specific type of events to be received. Each account shall be configurable to receive notification upon any combination of the following types of events:
  - a) Fire Alarm,
  - b) Priority 2,
  - c) Supervisory,
  - d) Trouble,
  - e) Custom Action Messages,
  - f) Fire Panel Internet Interface Security Violations
6. Each user account and distribution list shall be capable of being configurable for the specific content to be received. Each account shall be configurable to receive any combination of the following message content:
  - a) Summary,
  - b) Event Information,
  - c) Message,
  - d) Emergency Contacts,
  - e) Host Fire Alarm Control Unit Information
7. Each user account and distribution list shall be capable of being configurable for the type of Fire Alarm Control Unit Logs and Reports to be received. Each account shall be configurable to receive any combination of the following Logs and Reports via email:
  - a) Alarm Log,
  - b) Trouble Log,
  - c) Analog Sensor Status Report,
  - d) Analog Sensor Service Report,
  - e) Almost Dirty, Dirty and Excessively Dirty Sensor Report,

- f) CO Analog Sensor Service Report,
  - g) Addressable Notification Appliance Candela Report,
  - h) Addressable Notification Appliance Status Report
8. Each user account and distribution list shall be capable of receiving email distribution of Fire Alarm Control Unit Logs and Reports On-Demand or automatically on a Pre-Determined schedule. Receipt of Logs and Reports shall be capable of being scheduled as follows:
    - a) Weekly, or
    - b) Bi-weekly, or
    - c) Monthly
  9. The Fire Alarm Control Panel Logs and Reports shall be sent in CSV file format which can be imported into common database applications for viewing, sorting, and customization.
    - a) Each user account shall be capable of being configured to receive system events via email and/or SMS text messaging.
    - b) Each distribution list shall be capable of supporting up to 20 email address recipients.
  10. The means to provide email notification shall be compatible with SMTP mail servers, ISP email services, and Internet email services. Communication with the email server shall be verified at selectable intervals of 5 to 30 minutes.
  11. Email operation shall be capable of being disabled for service by the system administrator.
  12. An email log shall be accessible to authorized users. The email log shall display the 25 most recent email notifications sent.
  13. The fire panel internet interface for supplemental notification and remote user access shall support:
    - a) Secure HTTPS/SSL encrypted connections,
    - b) Up to 50 individual password protected user accounts,
    - c) Dynamic and Static IP addressing,
    - d) IP Address Blocking,
    - e) Restricted number of log-in attempts before lock-out configurable from 1 to 20,
    - f) Lock-out duration after unsuccessful log-in attempts configurable from 0 to 24 hours,
    - g) Email notification to Administrators of unsuccessful log-in attempts,
    - h) Automatic lock-out reset upon a new event,
    - i) Automatic inactivity logout configurable from 10 minutes to 24 hours,
    - j) Firmware updates over Ethernet,
    - k) Set-up and configuration via Local Service Port or via Remote Services over LAN/WAN connection
  14. Authorized users shall be capable of accessing the fire alarm panel using a compatible web browser (Internet Explorer 6.0 or higher) and a secure HTTPS/SSL encrypted connection.
  15. The fire panel internet interface shall support concurrent connections for up to 5 users plus 1 administrator.
  16. Authorized users with remote access shall be capable of:
    - a) Viewing the fire panel internet interface web home page
    - b) The fire panel internet interface home page shall display system status information and provide links to detailed status information and fire alarm panel reports and history logs
    - c) The web browser on the user's computer shall automatically refresh system status information upon a new event
    - d) Systems that require a manual refresh to acquire updated system status information shall not be accepted
    - e) Viewing the fire alarm panel detailed card status information
    - f) Viewing the fire alarm panel detailed point status information
    - g) Viewing the fire alarm panel reports and history logs
    - h) Viewing the fire panel internet interface email log
    - i) Viewing system summary information

- j) Accessing Custom Hypertext Links
- 17. The fire panel internet interface home page shall support customization to display the following information:
  - a) Customer Name and Address,
  - b) Fire Panel Location or Building Name,
  - c) Up to 10 Custom Hypertext Links with Text Descriptions

H. Remote Services Access:

1. Fire Alarm Control Panel (FACP) shall provide the necessary hardware to provide a remote service access feature using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Remote Access feature shall provide automatic notification of system faults and remote diagnostics of system status for responding technicians prior to arrival on site.
2. A standard RJ-45 Ethernet connection shall connect to the owner's Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
3. The Ethernet access feature shall be agency listed for specific interfaces and for the purpose described in this section. The use of non-listed external third party interfaces is not acceptable.
4. The internet remote access service function shall provide automated real time off-site reporting of discrete system events to a remote service support center with details of internal FACP fault conditions allowing a pre-site visit analysis of repair requirements.
5. Existing FACP controls shall be capable of retrofitting the Remote Service module as a plug-in upgrade feature.
6. The remote service network shall work on the customers Ethernet infrastructure and be Fire-Wall friendly for two-way communications for off-site reporting. The feature shall be compatible with existing proxy servers and firewalls shall not require any special changes or modifications.
7. The remote service system shall be able to connect to the remote service center without the need for a VPN account or similar tunnel.
8. The remote service system shall be a non-Windows based application to protect against conventional virus attacks.
9. The remote service system shall support a secure connection with strong encryption, 128 bit or better, and an optional secondary encryption method if required.
10. The remote service system shall be compatible with virtual LANS (VLAN).
11. The remote service system shall work on an outbound communication premise (panel calls home) in order to eliminate the possibility of any inbound connection into the network (from trusted or non-trusted sites).
12. The remote service system shall provide an audit trail of all events and service connections.
13. The Remote Service connection will provide access for panel software downloads and uploads for archiving job specific programs back at the enterprise server.
14. The supplier shall provide a service contract for the Remote Service program that provides the following requirements:
  - a) 24/7 recording of FACP service activity.
  - b) Off-site diagnostics by a technical specialist to provide repair and parts guidance to the service technician prior to a site visit.

I. Required Functions: The following are required system functions and operating features:

1. **Priority of Signals:** Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. **Noninterfering:** An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
3. **Transmission to an approved Supervising Station:** Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4. **Annunciation:** Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. **Selective Alarm:** A system alarm shall include:
  - a) Indication of alarm condition at the FACP and the annunciator(s).
  - b) Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
  - c) Operation of audible and visible notification appliances until silenced at FACP.
  - d) Closing doors normally held open by magnetic door holders.
  - e) Unlocking designated doors.
  - f) Shutting down supply and return fans building wide.
  - g) Closing smoke dampers on system building wide.
  - h) Initiation of smoke control sequence.
  - i) Transmission of signal to the supervising station.
  - j) Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, when specified detectors are activated, as appropriate.
6. **Supervisory Operations:** Upon activation of a supervisory device such as a sprinkler flow switch, and tamper switch, the system shall operate as follows:
  - a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
  - b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
  - c) Record the event in the FACP historical log.
  - d) Transmission of supervisory signal to the supervising station.
  - e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
7. **Alarm Silencing:** If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
8. **Priority Two Operations:** Upon activation of a priority two condition such as gas detection, the system shall operate as follows:
  - a) Activate the system priority two audible signal and illuminate the LED at the control unit and the remote annunciator.
  - b) Pressing the Priority 2 Acknowledge Key will silence the audible signal while maintaining the Priority 2 LED "on" indicating off-normal condition.
  - c) Record the event in the FACP historical log.
  - d) Transmission of priority two signal to the supervising station.

- e) Restoring the condition shall cause the Priority 2 LED to clear and restore the system to normal.
9. System Reset
- a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarms the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
  - b) Should an alarm condition continue, the system will remain in an alarmed state.
10. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
11. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
- a) The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
  - b) Control relay functions associated with one of the 8 testing groups shall be bypassed.
  - c) The control unit shall indicate a trouble condition.
  - d) The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
  - e) The unit shall automatically reset itself after signaling is complete.
  - f) Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
12. Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
- a) It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
  - b) It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.
13. Module Distribution:
- a) The fire alarm control unit shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
    - (1) Initiating Device Circuits
    - (2) Notification Appliance Circuits
    - (3) Auxiliary Control Circuits
    - (4) Graphic Annunciator LED/Switch Control Modules
      - ((a)) In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.
    - (5) Initiating Device Signaling Line Circuits
    - (6) Notification Appliance Signaling Line Circuits
    - (7) Power Supplies
    - (8) Voice System Amplifiers
14. Service Gateway: A Service Gateway software application shall be provided that allows an authorized service person to remotely query panel status during testing, commissioning, and service without the need to return to the panel using standard email or instant messaging

tools. For systems without a service gateway application the service provider shall provide a minimum of two technicians for any system testing or commissioning.

J. Integrated Automation

1. Building Automation and Control Network (BACnet) Integration
  - a) The fire alarm control unit shall be capable of providing a one-way communications interface between the fire alarm control unit and an industry-standard Building Automation and Control Network (BACnet) using ASHRAE® BACnet® IP (internet protocol) compliant with ANSI/ASHRAE Standard 135.
  - b) The BACnet communications module shall be agency listed to UL Standard 864.
  - c) The fire alarm control unit shall be capable of communicating up to 1000 status changes to the building automation system.
  - d) MS/TP Master and MS/TP Slave data link layer options communicating at baud rates up to 76,800 bps shall be supported.
  - e) A standard RJ-45 Ethernet connection to the Building Automation System Ethernet network shall be provided at the fire alarm control unit as part of the contract.
  - f) Systems using relay interfaces shall not be accepted.

K. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
  - a) Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
  - b) Where required, reports shall be accessible remotely through:
  - c) A Fire Panel Internet Interface using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Fire Panel Internet Interface shall be capable of automatically scheduling email reports to individual user accounts on a weekly, bi-weekly, or monthly schedule
  - d) A PC Annunciator using an RS232-C connection to the FACP or a PC Annunciator Client using a TCP/IP communications protocol connection to the PC Annunciator server compatible with IEEE Standard 802.3.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.



6. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
  7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
  8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
  9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- L. Fire Suppression Monitoring:
1. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
  2. Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
  3. Water flow: Activation of a water flow switch shall initiate general alarm operations and remote sprinkler system activation bell.
- M. Audible Alarm Notification: By horns in areas as indicated on drawings.
- N. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.
1. Automatic Voice Evacuation Sequence:
    - a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
    - b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.
- O. Speaker: Speaker notification appliances shall be listed to UL 1480.
1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
  2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
- P. Manual Voice Paging
1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group .
  2. The control unit operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
  3. Total building paging shall be accomplished by the means of an "All Call" switch.
- Q. Constant Supervision of Non-Alarm Audio Functions

1. When required, the system shall be configured to allow Non-Alarm Audio (NAA) functions such as background music or general/public address paging.
2. During NAA operation, the speaker circuit shall be electrically supervised to provide continuous monitoring of the speaker circuit.
3. During an alarm condition, supervision shall be disabled and alarm signals delivered to speakers.

R. Network Communication:

1. Network node communication shall be through a token ring, hub, or star topology configuration, or combination thereof.
2. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.
3. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.
4. The communication method shall be NFPA 72 style 7.

S. Network Synchronization of Notification Appliances

1. The fire alarm and emergency communications network shall be capable of providing UL Listed synchronization across all the notification appliance circuits for all panels on a network loop in accordance with the requirements of UL 1971.
2. Systems that require all notification appliances to be connected to a single panel for synchronization thus creating a potential single point of failure shall not be acceptable.
3. Up to 99 panels on a network loop shall be capable of UL Listed synchronization of all notification appliance circuits across the network loop in accordance with the requirements of UL 1971.
4. Should network communications be disrupted, re-synchronization shall occur across all nodes that continue to communicate together after network re-initialization is completed and restored to affected nodes.
  - a) Addressable Notification Appliances (Applies only where addressable notification is provided):
5. Monitoring: The FACP shall monitor individual addressable notification appliances for status, condition, type of appliance, and configured appliance settings. A fault in any individual appliance shall automatically report a trouble condition on the FACP.
6. Individual Appliance Custom Label: Each addressable appliance shall have its own 40 character custom label to identify the location of the appliance and to aid in troubleshooting fault conditions.
7. Individual Appliance Information Display:
  - a) The FACP shall be capable of calling up detailed information for each addressable appliance including the appliance location, status, condition, type of appliance, and configured appliance settings.
  - b) Notification appliances that are not capable of communicating and reporting their individual location, status, condition, type of appliance, and configured appliance settings to the FACP shall not be accepted.
8. Programmable Appliance Settings:

- a) The selectable operation of each addressable notification appliance shall be capable of being configured by the FACP without having to replace or remove the appliance from the wall or ceiling.
  - b) Programmable appliance settings for applicable addressable notification appliances shall include:
    - (1) Operation:
      - ((a)) General Evac
      - ((b)) Alert
      - ((c)) User Defined
    - (2) Style:
      - ((a)) Indoor
      - ((b)) UL Weatherproof
      - ((c)) ULC Weatherproof
    - (3) Candela Selections:
      - ((a)) Indoor: 15, 30, 75, 110, 135, or 185 cd (per UL1971)
      - ((b)) UL Weatherproof: 15 or 75 cd (per UL1971), and 75 or 185 cd (per UL1638)
      - ((c)) ULC Weatherproof: 20, 30 or 75 cd (per ULCS526)
    - (4) Horn Volume:
      - ((a)) Hi
      - ((b)) Low
    - (5) Horn Cadence:
      - ((a)) Temporal 3
      - ((b)) Temporal 4
      - ((c)) March Time 20 bpm
      - ((d)) March Time 60 bpm
      - ((e)) March Time 120 bpm
      - ((f)) Steady
    - (6) Horn Tone:
      - ((a)) 520 HZ
      - ((b)) Bell
      - ((c)) Slow Whoop
      - ((d)) Siren
      - ((e)) Hi / Lo
  - c) Systems that require replacement or removal of the appliances from the wall or ceiling to change their applicable operation or settings shall not be accepted.
9. Programmable Notification Zones:
- a) Changing the notification zone assigned to a notification appliance shall be configurable by the FACP and shall not require additional circuits or wiring.
  - b) Systems that require additional circuits and wiring to change the notification zone assigned to a notification appliance shall not be accepted.
10. Other Emergency and Non Emergency Notification:
- a) Where required, notification appliances for purposes not related to fire alarm shall be capable of:
    - (1) being connected to the same circuit as the fire alarm appliances, and
    - (2) being individually configured for their intended use without requiring additional circuits or wiring.
  - b) Systems that require separate circuits and wiring for other Emergency and Non Emergency notification shall not be accepted.
11. Addressable Notification Appliance Automated Self-Test:
- a) The fire alarm control unit shall be capable of performing an automated functional self-test of all self-test notification appliances and meet the requirements in NFPA 72, 2013 Edition, 14.2.8 Automated Testing and Table 14.4.3.2 testing requirements.
  - b) Test results for each self-test notification appliance shall be stored in non-volatile memory at the fire alarm control unit.

- c) The fire alarm control unit shall be capable of running a functional automated test for all self-test notification appliances in a general alarm group or for all self-test appliances within a specific notification zone.
  - d) The duration required to complete the automated functional test for all self-test notification appliances shall be accomplished in 2 minutes or less.
  - e) The automated test results for all self-test notification appliances shall be available from the fire alarm control unit within 4 minutes from the start of the test.
  - f) If any notification appliance fails its automated functional self-test an audible and visual trouble signal shall be annunciated at the fire alarm control unit.
    - (1) The self-test trouble signal shall be a latching trouble signal which requires manual restoration to normal .
12. Addressable Notification Appliance Reports:
- a) The fire alarm control unit shall maintain configuration and test data for each self-test addressable notification appliance.
  - b) The fire alarm control unit shall be capable of generating configuration, self-test, and deficiency reports, that can be viewed through the fire alarm control unit user interface or printed via the fire alarm control unit service port.
    - (1) At minimum, the configuration report shall include the following information applicable for each addressable notification appliance:
      - ((a)) Point ID
      - ((b)) Custom Label
      - ((c)) Device Type
      - ((d)) Candela Setting
    - (2) At minimum, the self-test report shall include the following information applicable for each self-test notification appliance:
      - ((a)) Point ID
      - ((b)) Custom Label
      - ((c)) Time and Date of last test
      - ((d)) Pass / Fail results of last visual test
      - ((e)) Pass / Fail results of last audible test
      - ((f)) The fire alarm control unit shall also be capable of providing a deficiency report that includes a list of all self-test notification appliances that have failed self-test.
13. Magnet test: When the control unit is in diagnostic mode, the appliances shall be capable of being tested with a magnet. The magnet diagnostics shall:
- a) Pulse the appliance LED to indicate appliance address, briefly sound the individual horn to confirm the audible appliance operation. [briefly flash the individual strobe to confirm visible appliance operation]

#### 1.06 GENERAL SUBMITTAL

- A. Provide list of all types of equipment and components provided. This shall be incorporated as part of a Table of Contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
- B. Provide description of operation of the system (Sequence of Operation), similar to that provided in Part 2 of this Section of the Specifications, to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. The sequence of operation shall be project specific and shall provide individual sequences for every type of alarm, supervisory, or trouble condition, which may occur as part of normal or off-normal system use.
- C. Provide manufacturer's ORIGINAL printed product data, catalog cuts and description of any special installation procedures. Photocopied and/or illegible product data sheets shall not be acceptable. All product datasheets shall be highlighted or stamped with arrows to indicate the specific components being submitted for approval.
- D. Provide manufacturer's instruction manual for specified system.
- E. Provide copy of State License to perform such work.

F. Provide copies of NICET Level II Fire Alarm certifications for the two (2) technicians assigned to this project.

G. Provide shop drawings as follows:

1. Coversheet with project name, address and drawing index.
2. General notes drawing with peripheral device backbox size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contract project team members.
3. Device riser diagram that individually depicts all control panels, annunciators, addressable devices, and notification appliances. Shall include a specific, proposed point descriptor above each addressable device. Shall include a specific, discrete point address that shall correspond to addresses depicted on the device layout floor plans. Drawing shall provide wire specifications, and wire tags shown on all conductors depicted on the riser diagram. All circuits shall have designations that shall correspond with those require on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
4. Control panel termination drawing(s). Shall depict internal component placement and all internal and field termination points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data gathering panel, a separate control panel drawing shall be provided, which clearly indicated the designation, service and location of the control enclosure. End-of-line resistors (and values) shall be depicted.
5. See section 3.4 DOCUMENTATION AND TRAINING for other documents relating to this section.
6. Device typical wiring diagram drawing(s) shall be provided which depict all system components, and their respective field wiring termination points. Wire type, gauge, and jacket shall also be indicated. When an addressable module is used in multiple configurations for monitoring or controlling various types of equipment, different device typical diagrams shall be provided. End-of-line resistors (and values) shall be depicted.
7. Device layout floor plans shall be created for every area served by the fire alarm system. CAD Files (AutoCAD latest version) shall be provided by the consulting engineer for the use of the fire alarm system equipment vendor in the preparation of the floor plans. Floor plans shall indicate accurate locations for all control and peripheral devices. Drawings shall be NO LESS THAN 1/8 INCH SCALE. All addressable devices shall be depicted with a discrete address which corresponds with that indicated on the Riser Diagram. All notification appliances shall also be provided with a circuit address which corresponds to that depicted on the Riser Diagram. If individual floors need to be segmented to accommodate the 1/8" scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. End-of-line resistors (and values) shall be depicted.
8. Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes. The initial submission shall be Revision 0, with Revision Am, B, or C as project modifications require.

H. Battery calculations shall be provided on a per power supply/charger basis. These calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements (which reflect a 20% DEGRADE, for 24 Hour supervisory, 15 minute alarm operation). Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws. Failure to provide these calculations shall be grounds for the complete rejection of the submittal package.

I. Table of contents, product data sheets, sequences of operation, battery calculations, installation instructions, licenses, NICET certifications and B-Size (blackline) reduced shop drawings shall be provided by the fire alarm vendor as part of a single, spiral bound submittal book. The submittal book shall have laminated covers indicating the project address, project number, system type, and contractor. The book shall consist of labeled dividers, and shall not exceed 9 1/2" in width, and 11 1/2" in height. No less than three (3) sets of submittal booklets shall be provided to the consulting engineer for review and comment. Additional copies may be required at no additional cost to the project.

J. Scale drawing sets shall be submitted along with the submittal booklets. These drawings may be either D-Size or E-Size Blue-line drawings and of a sufficient resolution to be completely read. Sets shall be bound and folded so that it does not take up more than 100 square inches of space. No less than

three (3) sets of scale drawing sets shall be provided to the consulting engineer for review and comment. Additional copies may be required at no additional cost to the project.

K. Scaled drawings showing the intelligible speaker layout with all ADS (Acoustically Distinguishable Spaces) locations.

## 1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

## 1.8 CLOSEOUT SUBMITTALS

C. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.

3. Record copy of site-specific software.

4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

a. Frequency of testing of installed components.

b. Frequency of inspection of installed components.

c. Requirements and recommendations related to results of maintenance.

d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.

6. Abbreviated operating instructions for mounting at fire-alarm control unit.

D. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

## 1.9 Submission to Authorities Having Jurisdiction:

A. In addition to routine submission of the above material, make an identical submission to the authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Upon receipt of comments from the authorities having jurisdiction, submit them for review. Resubmit if required to make clarifications or revisions to obtain approval.

B. Extra Materials: Submit one month prior to date of Substantial Completion.

C. Submit certification for training of Owner's Maintenance personnel.

#### 1.10 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke Detectors and Fire Detectors: Quantity equal to 5 percent of amount of each type installed, but no less than 1 unit of each type.

2. Audible and Visual Notification Appliances: 5 percent of amount of each type installed.

#### 1.10 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

#### 1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by the Authority or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

#### 1.11 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to the Authority to allow scheduling and access to system and to allow the Authority to upgrade computer equipment if necessary.

#### 1.12 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance or approval by AHJ. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: A factory-authorized Installer to perform work of this Section.
- B. Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components.
- C. Compliance with Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authorities having jurisdiction.
- D. Comply with NFPA 70.
- E. Comply with NFPA 72.
- F. Listing and Labeling: Provide systems and equipment specified in this Section that are listed and labeled.
- G. Provide services of manufacturer's factory-authorized service representative to supervise field quality control.
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

#### 1.08 SOFTWARE TERMS

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade to include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

#### 1.09 WARRANTY

- A. Provide a one year labor and materials warranty on the complete system. Provide all maintenance during the warranty period at no cost to the owner.

#### 1.010 EXTRA MATERIALS



- A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
  - 1. Notification Appliances: Furnish quantity equal to 10 percent of each type and number of units installed, but not less than one of each type.
  - 2. Smoke Detectors and Heat Detectors: Furnish quantity equal to 10 percent of each type and number of units installed, but not less than one of each type.
  - 3. Detector Bases: Furnish quantity equal to 2 percent of each type and number of units installed, but not less than one of each type.
  - 4. Printer ribbons: Furnish 6 spare printer ribbons.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

- A. Manufacturers: Subject to compliance with the requirements of this specification, provide products by one of the following:
  - 1. Simplex, a Tyco Company.
  - 2. FCI – Fire Control Instruments, Inc.
  - 3. Edwards Systems Technologies.
  - 4. Basis-of-Design: Edwards; A UTC Building & Industrial Systems. The catalog numbers used are those of Edwards EST by UTC Fire and Security and constitute the type and quality of equipment to be furnished or approved equal.
- B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.
- C. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
- D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and certified technicians, and shall maintain a service organization within 50 miles of this project location. The equipment and service provider shall have a minimum of 10 years experience in the fire protective signaling systems industry.

### 2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Verified automatic alarm operation of smoke detectors.

6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.
8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Activate voice/alarm communication system.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Recall elevators to primary or alternate recall floors.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.
11. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal AC voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer where provided.

## 2.03 FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACP hardware shall be provided:

1. Power Limited base panel with red cabinet and door, 120 VAC input power.

2. 2,500 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2000 points of annunciation where one (1) point of annunciation equals:
  - a) 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
  - b) 1 LED on panel or 1 switch on panel.
4. 9 Amp Power Supply minimum with temperature compensated, dual-rate battery charger capable of charging up to 110 Ah batteries without a separate external battery charger. Battery charger voltage and amperage values shall be accessible on the FACP LCD display.
5. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
7. Three (3) Class B Addressable Notification Appliance Signaling Line Circuits (SLCs).
  - a) Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 127 Notification Appliances per channel.
  - b) Wiring shall be 18 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances shall not be accepted.
  - c) A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACU to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
  - d) For systems that do not provide a constant voltage source at the FACU notification appliance field wiring terminal connections, the fire alarm contractor shall:
8. Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
9. Perform a complete functional test of all notification appliances under worst case secondary power conditions.
10. Three (3) Class B Notification Appliance Circuits (NAC; rated 3A@24VDC, resistive).
11. NAC's shall be conventional reverse polarity operation and shall be for synchronized strobes and independent horn/strobe operation over two wires.
  - a) NACs shall be selectable as auxiliary power outputs derated to 2 A for continuous duty.
  - b) Strobe synchronization and audible cadence synchronization shall be across all panel NAC circuits. Systems that cannot provide listed synchronization across all panel NAC's shall not be acceptable.
12. Where required provide Intelligent Remote Battery Charger for charging up to 50Ah batteries.
13. Expansion Power Supplies with three (3) Class B integral Intelligent Addressable Notification Appliance Signaling Line Circuits (SLCs) for system expansion. Expansion power supplies shall provide complete capability as the primary power supply.
14. Power Supplies with integral conventional reverse polarity Notification Appliance Circuit Class B for system expansion. Expansion power supplies shall provide complete capability as the primary power supply.
15. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory or other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
16. Where required, the FACP shall support up to (5) RS-232-C ports. Each RS-232 Port shall be capable of two-way communications.
17. Remote Unit Interface: supervised Class B (Style 4) or Class X (Style 7) signaling line circuit (SLC) for control and monitoring of remotely located annunciators and I/O panels.

18. Modular Network Communications Card.

- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If a more than single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
  - 1. The system shall include the necessary hardware to provide expanded content, multi-line, operator interface displays. The expanded content multi-line displays shall be Quarter-VGA (QVGA) or larger and be capable of supporting a minimum of 854 standard ASCII characters to minimize or eliminate the levels of navigation required for access to information when responding to critical emergencies and abnormal system conditions. The QVGA operator interface shall provide operator prompts and six context sensitive soft-keys for intuitive operation.
    - a) Expanded content, multi-line operator interfaces shall be capable of providing the following functions:
      - (1) Dual language operation with Instant-Switch language selection during runtime.
      - (2) Activity display choices for:
        - ((a)) First 8 Events.
        - ((b)) Scrollable List Display displays a scrollable list of active points for the event category (alarm, priority 2, supervisory, or trouble) selected. The position in this list will be the last acknowledged point (not flashing) at the top followed by the next 7 unacknowledged points (flashing)
        - ((c)) General Event Status (alarm, priority 2, supervisory, or trouble in system)
        - ((d)) Site Plan
      - (3) Equal or hierarchal priority assignment. In systems with two or more operator interfaces, each operator interface shall be programmable to allow multiple operator interfaces to have equal operation priority or to allow hierarchal priority control to be assigned to individual operator interfaces (locations).
      - (4) Up to 50 custom point detail messages for providing additional point specific information in detailed point status screens.
      - (5) Bitmap file import for operator interface display of site plan and background watermark images. Site plan status icons shall indicate area status for highest priority active events.
- E. Distributed Module Operation: FACU shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
  - 1. Addressable Signaling Line Circuits
  - 2. Initiating Device Circuits
  - 3. Notification Appliance Circuits
  - 4. Auxiliary Control Circuits
  - 5. Graphic Annunciator LED/Switch Control Modules
    - In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.
    - (1) Amplifiers, voice and telephone control circuits.

- F. Voice Alarm: Provide an emergency communication system, integral with the FACU, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as background music and general paging.
  2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
  3. Eight channel digitally multiplexed audio for systems that require more than two channels of simultaneous audio. Up to 8 channels of audio shall be multiplexed on either a style 4 or style 7 twisted pair.
  4. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
  5. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.
  6. When required, Redundant Voice Command Centers shall be capable of generating voice paging from more than one node in a network audio system.

G. Evacuation System - Non-Alarm Audio

1. The fire alarm control panel shall provide non-alarm audio from an owner supplied paging and/or music source over the fire alarm evacuation speakers. This feature shall be an integral part of the fire alarm system, and shall use some or all of the audio components from the fire alarm evacuation system.
2. The fire alarm system and the non-alarm audio operation shall comply with NFPA 72 requirements for non-emergency purposes at a fire command center that is not constantly attended by a trained operator.
3. All fire alarm system hardware and software shall be U.L. listed for non-alarm audio use. The fire alarm system shall supervise for system hardware and field wiring faults while playing non-alarm audio over the evacuation speakers. Any hardware failure or speaker circuit fault detected when the system is playing non-alarm audio shall report a trouble on the fire alarm control unit. All audio components used for both the non-alarm audio and the fire alarm evacuation system shall be manufactured by the same supplier.
4. The non-alarm audio shall have two dedicated audio inputs to the fire alarm control panel. Terminal strip connections and an industry standard RCA receptacle shall be provided at the fire alarm control unit for terminating the owner's audio source. The fire alarm input shall be 600-Ohm impedance. The inputs on the fire alarm control unit shall be electrically isolated via an isolation transformer.
5. The fire alarm control panel shall accept industry standard "line level audio input" from the owner's non-alarm audio source. The fire alarm system hardware and software shall distribute the audio over the fire alarm evacuation speakers. The selection of which speaker zones to distribute the non-alarm audio to the building occupants shall be coordinated with the owner's representative.
6. The fire alarm control panel shall be able to make audio input level adjustments from the owner's non-alarm audio source. This adjustment will match the non-alarm audio source to

the fire alarm input. After the audio levels are adjusted, the owner shall control the volume level from the non-alarm audio source.

7. The fire alarm system will have the capability to provide operator "keys" that will adjust the volume level of pre-assigned non-alarm audio zones. The volume level of non-alarm audio that is being broadcast to any audio zone will also be individually adjustable by time of day via a pre-specified schedule.
8. The non-alarm audio shall be the lowest priority audio on the fire alarm system. The non-alarm audio shall not interfere with any of the fire alarm emergency signals that may include live voice, pre-recorded emergency voice messages, or any alert tones. Switches shall be located on the fire alarm control unit to turn on or off the non-alarm audio system feature. The fire alarm control unit shall have LED lamps to indicate the ON vs. OFF status of the non-alarm audio feature. Speaker circuits that are actively broadcasting non-alarm audio will also be indicated by LEDs.
9. The non-alarm audio shall be synchronized throughout the fire alarm life safety system amplifiers and speaker circuits. Any remote amplifier panels located on the fire alarm system network shall also be synchronized. The system shall be capable of accepting a system-wide non-alarm audio input at the main fire alarm control or another local non-alarm audio input at a remote amplifier panel to serve only the areas served by that remote panel.
10. Multiple non-alarm audio sources must be accessible by the fire alarm non-alarm audio system. Each separate non-alarm audio source will have the ability to be broadcast into a distinct fire zone, depending on occupant preference. Any system restricted to a limited number of non-audio sources will not be accepted. The system must have the capability of broadcasting an unlimited number of non-alarm sources, except as determined by the number of individual fire zones served by the fire alarm system.
11. Non-alarm audio shall be automatically turned off in the event of primary power failure to the fire alarm control unit or any of the remote amplifier panels controlled by the main fire alarm control unit.

## 2.04 ADDRESSABLE INITIATING

### A. ADDRESSABLE MANUAL PULL STATIONS

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable double-action type, red LEXAN. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit. Where double-action stations are provided, the mechanism shall require two actions push top activation door to initiate an alarm.
3. Provide with a front showing red LED showing that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Indoor Protective Shield: All manual pull stations in building, provide a factory-fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed. Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

## B. ADDRESSABLE ANALOG SMOKE DETECTORS

1. General Requirements for System Smoke Detectors:
  - a) Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
  - b) Factory Nameplate: Serial number and type identification.
  - c) Operating Voltage: 24 VDC, nominal and shall be two-wire type.
  - d) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
  - e) Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. Provide terminals in the fixed base for connection to building wiring. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit. Sensors shall include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor base shall contain an integral visual-indicating LED that will flash to provide power-on status each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Quick Connect Arrangement: Photoelectric sensor and electronics in a single piece construction which shall twist-lock onto a mounting base that attaches to a standard electrical box. Provide terminals in the fixed base for connection to building wiring. Sensors shall include an internal communication transmitter and receiver in the sensor having a unique identification and capability for status reporting to the FACP. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor shall contain an integral visual-indicating LED that will flash to provide power-on status each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor LED shall be on steady. Sensor and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.
  - f) Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.
  - g) Each sensor shall be scanned by the Control Panel for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
  - h) Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.
  - i) Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
  - j) The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.
  - k) Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2. Addressable Sensor Bases

- a) Standard base - Twist lock addressable base with address selection DIP switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.

C. ADDRESSABLE DUCT SMOKE DETECTORS

1. Standard Addressable Duct Smoke Detector Unit. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
  - a) Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke detector shall be provided by the FACP.
  - b) The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
  - c) Duct Housing shall provide a magnetic test area and Red detector status LED and Duct Housing shall provide a relay control Yellow LED trouble indicator.
  - d) Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
  - e) Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
  - f) For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
  - g) Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
  - h) Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

D. ADDRESSABLE HEAT DETECTORS

1. General Requirements for Heat Detectors: Comply with UL 521.
2. Thermal Sensor Combination type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
3. Thermal detector shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.
4. Mounting: Twist-lock base interchangeable with smoke-detector heads.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
6. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
7. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.



8. Unless otherwise indicated, sensors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.
  - a) Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
  - b) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

#### E. ADDRESSABLE CO SENSOR

1. Addressable CO Sensor
  - a) The CO Sensor shall be an addressable carbon monoxide (CO) sensing module providing both CO toxic gas detection and enhanced fire detection, and shall be listed to UL 268, Smoke Detectors for Fire Alarm Signaling Systems and UL 2075, Gas and Vapor Detectors and Sensors; allowing systems to be listed to UL 2034, Single and Multiple Station Carbon Monoxide Alarms.
  - b) The CO Sensor shall include CO sensor element mounted in the sensor base which can be easily replaced without replacing the complete sensor base assembly.
  - c) The CO Sensor base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
  - d) The CO Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
  - e) CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.
  - f) The CO Sensor shall provide a 10 year life expectancy before replacement is necessary or required.
  - g) The CO Sensor base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.
2. Addressable CO Sensor Sounder Base
  - a) The CO Sensing element shall support operation with a Sounder base; the CO Sensor Sounder base shall provide temporal code 3 (TC3) for fire, or temporal code 4 (TC4) for toxic carbon monoxide alarms.
  - b) The CO Sensor Sounder base shall be listed to UL464, Audible Signal Appliances.
  - c) CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.
  - d) The CO Sensor Sounder Base shall include CO sensor element mounted in the sounder base which can be easily replaced without replacing the complete sensor base assembly.
  - e) The CO Sensor Sounder base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
  - f) The CO Sensor Sounder Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
  - g) The CO Sensor Sounder base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.
  - h) The CO Sensor Sounder Base shall be interchangeable with the CO Sensor 520 Hz Sounder Base.

#### F. ADDRESSABLE CIRCUIT INTERFACE MODULES

1. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, fan shutdown relays, valve tamper, non-addressable devices, and for control of AHU and exhaust systems.

2. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
3. All Circuit Interface Control Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

## 2.05 ADDRESSABLE NOTIFICATION

### A. ADDRESSABLE ALARM NOTIFICATION APPLIANCES

1. Addressable Notification Appliances: The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
  - a) Addressable Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
  - b) All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows "On the fly" program operation changes for Mass Notification alerting and fire alarm notification.
  - c) All Notification Appliances shall operate as a completely independent device allowing for appliances in handicap accessible rooms and other locations to operate on the same SLC and to activate individually based on an alarm condition in a room or as part of a general alarm condition where all appliances activate together.
  - d) Individual Notification Appliances shall be able to be grouped into zones (or operational groups) by central programming at the main fire alarm control unit.
  - e) Notification Appliances shall provide for "unobtrusive" testing. Each Notification Appliance shall be tested for audible and visible operation on an individual basis at the device or from the main fire alarm control unit, allowing for minimal invasive impact.
  - f) Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 127 addresses can be supported on a single channel.
  - g) Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
  - h) Each addressable notification appliance shall have electrical test point access without removing the device cover.
  - i) Both wall mount and ceiling mount devices shall be available.
2. Addressable Visible/Only strobe device: Addressable strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special

adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.

3. Addressable Audio Speaker Device: Addressable Speaker notification appliances shall be listed to UL 1480. Individual device level supervision and activation control shall be provided by the fire alarm control unit.
  - a) Speakers shall be individually powered, addressed, and controlled from a compatible fire alarm control unit Signaling Line Circuit (SLC) using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Shielded cable shall not be required.
  - b) Speakers shall provide for Fire Alarm and General Signaling functionality in a single unit, eliminating additional devices. Device "Self-Test" shall be supported by a compatible fire alarm control unit and shall be UL listed and NFPA 72 compliant. Speakers shall be UL listed to provide a 520Hz audio tone in compliance with NFPA 72 for sleeping areas.
  - c) The speaker audio shall be provided by a standard 25VRMS or 70.7VRMS audio circuit using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Supervision of this circuit shall be provided by the addressable speaker. Shielded cable shall not be required.
  - d) Speaker power taps shall be at a minimum of 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker shall have a minimum UL rated sound pressure level of 86dBA at 10 feet for the Standard Output version and 84dBA at 10 feet for the High Fidelity version.
  - e) Speakers shall be available in either "Standard Output" with a minimum frequency response of 400 to 4000 Hz or in "High Fidelity Output" with a minimum frequency response of 200 to 10,000 Hz. Standard Output speakers shall use a multi-tapped speaker for audio/tone notification.
  - f) Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
  - g) The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
4. Addressable Speaker/Visible Device: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker shall operate on a 25VRMS or 70.7VRMS NAC.
  - a) Operational functions and features of Addressable Speaker above shall apply to this section. Operational functions and features of Addressable Strobe above shall apply to this section.
  - b) Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
  - c) The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
5. Addressable Weatherproof Visible strobe Only Device: Addressable weatherproof strobe shall be UL 1971 listed for indoor applications with strobe intensity selectable as 15 or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75) or 185 cd (WP185). The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The

V/O appliance shall be provided with multiple minimum flash intensities of 15, 75, WP 75, or WP 185 candela. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.

6. Weatherproof Addressable Speaker/Visible Device: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker shall operate on a 25VRMS or 70.7VRMS NAC.
  - a) Operational functions and features of Addressable Speaker above in Item 3 shall apply to this section. Operational functions and features of Addressable Strobe above shall apply to this section.
  - b) Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
  - c) The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.

#### B. NAC Power Extender

1. The SLC NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B, Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
2. The internal power supply and battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
3. The NAC extender panel may be mounted close to the host control unit or can be remotely located. The SLC Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an SLC communications channel. Via the SLC channel each output NAC can be individually controlled for general alarm or selective area notification.
4. For SLC connected NAC extender panels up to five panels can be connected on a single SLC channel.
5. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control unit may be used to activate all the circuits on the NAC power extender panel.
6. Alarms from the host fire alarm control unit shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

### 2.06 MAGNETIC DOOR HOLDERS

- A. Description: Units provided in door hardware specification 087100. Unit shall be connected to fire alarm system and operate from a 120VAC, a 24VAC or a 24VDC source.
- B. Material and Finish: Match door hardware.

### 2.07 REMOTE QVGA LCD ANNUNCIATOR

- A. Provide a remote QVGA LCD Annunciator, where required, with the same "look and feel" as the FACP operator interface. The Remote QVGA LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys as the FACP.
- B. The QVGA Annunciator shall have an expanded content, multi-line display capable of supporting a minimum of 854 standard ASCII characters to minimize or eliminate the levels of navigation

required for access to information when responding to critical emergencies and abnormal system conditions. The QVGA Annunciator shall provide:

1. Operator prompts and six context sensitive soft-keys for intuitive operation.
  2. Seven (7) programmable control switches and associated LEDs.
  3. Three (3) programmable general purpose LEDs.
  4. Capability of supporting Dual Languages with Instant-Switchover between languages in runtime operation.
  5. Support for both one-byte and two-byte characters.
- C. Under normal conditions the QVGA LCD shall display a "SYSTEM IS NORMAL" message, the current time and date, and the quantity of abnormal status conditions for each event category (i.e., fire alarm, priority 2, supervisory, and trouble) with a watermark background image a site plan of the facility layout with status icons to indicate area status for highest priority active events.
- D. The QVGA Annunciator shall be programmable for the following Activity display choices:
1. First 8 Events.
  2. First 5 Events and Most Recent Event with First and Most Recent event time and date stamps.
  3. First Event and Most Recent Event with First and Most Recent event time and date stamps.
  4. Scrollable List Display displays a scrollable list of active points for the event category (alarm, priority 2, supervisory, or trouble) selected. The position in this list will be the last acknowledged point (not flashing) at the top followed by the next 7 unacknowledged points (flashing).
  5. General Event Status (Alarm, Priority 2, Supervisory, or Trouble in system).
  6. Site Plan with optional status icons to indicate area status for highest priority active events.
- E. Should an abnormal condition be detected the appropriate LED (Alarm, Priority 2, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- F. The QVGA LCD shall display the following minimum information relative to the abnormal condition of a point in the system:
1. 40 character custom location label.
  2. Type of device (e.g., smoke, pull station, waterflow).
  3. Point status (e.g., alarm, trouble).
- G. QVGA Annunciators shall be protected from unauthorized use via a locked door or equivalent means. In addition, in systems with two or more Annunciators, each Annunciator shall be programmable to allow multiple Annunciators to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciators (locations). Acknowledge, Silence and Reset operation shall be the same as the FACP.

## 2.08 GRAPHIC ANNUNCIATOR - LED TYPE

- A. Annunciator Unit, zoned system: Provide an LED-indicating light located on the floor plan for each zone. Mark zone boundaries on the annunciator floor plan.
- B. Annunciator Unit, addressable system: Provide an LED-indicating light located on the floor plan for each device indicating the type of device and floor on which a signal was actuated.

- C. Provide individual LED indicators for each alarm and supervisory device or zone and a LED to indicate system trouble. Additional LEDs indicate normal power and emergency power modes for the system. A toggle or push-button switch tests the LEDs mounted on the unit. The test switch does not require key operation.
- D. Enclosure: Finish to match Fire Alarm Control Units. The locking cover/display assembly is hinged on the left. Key and lock shall be common to all secured fire alarm system enclosures.

## 2.09 NETWORK ANNUNCIATORS

- A. Network Display Unit (NDU) shall contain the following features:
  - 1. 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
  - 2. Capacity to annunciate 12,000 network points and/or point lists.
  - 3. Historical event logs shall maintain separate 1,250 Alarm and 1,250 Trouble events.
  - 4. The network shall provide a means to log into any node on the system via a laptop computer and have complete network access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network.
  - 5. A DACT with partitioning capability shall be available as an option that shall receive an alarm, supervisory, or trouble signal from any network connected fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station.
    - a) When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, DACT shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line.
    - b) DACT shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
    - c) Digital data transmission shall include the following:
      - (1) Address and node information of the alarm-initiating device.
      - (2) Address and node information of the supervisory signal.
      - (3) Address and node information for trouble condition.
      - (4) Abnormal test signal.
      - (5) Communication failure.
    - d) Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
  - 6. The Network Display Unit shall support up to (5) RS-232-C ports and one service port. All (5) RS-232 Ports shall be capable of two-way communications. RS-232-C printer ports shall provide activity log and on demand report print-outs for all network activity.
  - 7. A Remote Unit Interface shall be available to provide supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
  - 8. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
  - 9. Remote Services Access:

- a) The Network Display Unit shall have the capability to provide a remote service access feature using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Remote Access feature shall provide automatic notification of system faults and remote diagnostics of system status for responding technicians prior to arrival on site.
  - b) A standard RJ-45 Ethernet connection shall connect to the owner's Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
  - c) Operation shall be as described under Section 1.5 SYSTEM DESCRIPTION; Remote Services Access.
10. Supplemental Notification and Remote User Access (Fire Panel Internet Interface).
- a) The Network Display Unit shall have the capability to provide supplemental notification and remote user access to the FACP using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
  - b) A standard RJ-45 Ethernet connection shall connect to the owner's Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
  - c) Operation shall be as described under Section 1.5 SYSTEM OPERATION; Supplemental Notification and Remote User Access (Fire Panel Internet Interface).

## 2.010 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  - 1. Verification that both telephone lines are available.
  - 2. Programming device.
  - 3. LED display.
  - 4. Manual test report function and manual transmission clear indication.
  - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  - 1. Address of the alarm-initiating device.
  - 2. Address of the supervisory signal.
  - 3. Address or loss of power.
  - 4. Low battery.
  - 5. Abnormal test signal.
  - 6. Communication bus failure.

- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.011 RESCUE ASSISTANCE SYSTEM

- A. Rescue Assistant System: System provides two way voice communications between the Rescue Assistant Station (RAS) and the Rescue Assistant Master Telephone (RMT).
  - 1. When the "Push for Assistance" button at the RAS is pressed the LED starts to Flash and a tone is sounded indicating the call has been placed.
  - 2. The RMT begins to ring and the number of the calling station is displayed.
  - 3. Communication is established by lifting the handset at the RMT.
  - 4. When the call has been answered at the RMT, the LED at the RAS will flash at a slower rate and a dual tone is sounded.
  - 5. Upon completion of the call, the LED at the RAS becomes steady and remains lighted until the reset button at the station is activated.
  - 6. Communication between the stations is voice activated and does not require push to talk switches.
  - 7. System shall provide access to public (outside) telephone line to allow for a call to be placed to notify authorities of alarm.
- B. Control Panel (RASP): Metal enclosure housing the card frame, CPU, power converter board and graphic I/O board power supply. System shall have minimum capacity of 8 stations.
- C. Rescue Assistance Station: Flush mounted Faceplate with the following:
  - 1. Inscription reading "Area of Rescue".
  - 2. "Push For Assistance" button.
  - 3. Speaker located behind faceplate grille.
  - 4. LED with faceplate inscription "FLASHING - Call Placed, STEADY- Help coming".
  - 5. Reset switch.
  - 6. Access to public telephone line to place a call to a designated location to notify of alarm.
- D. Rescue Assistance Master Telephone: Flush mounted enclosure with the following:
  - 1. Handset located behind locking door.
  - 2. LCD readout of location where call was placed and Time/Date of call.
  - 3. Faceplate inscription reading "Area of Rescue Assistance Master Telephone".

## 2.012 SYSTEM PRINTER

- A. General: Provide a dot-matrix type, listed and labeled as an integral part of the fire alarm system.

## 2.013 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  - 1. Factory fabricated and furnished by manufacturer of device.



2. Finish: Paint of color to match the protected device.

#### 2.014 EMERGENCY POWER SUPPLY

- A. General: Components include Maintenance free lead Calcium battery, charger, and an automatic transfer switch.
- B. Battery capacity is adequate to operate the complete alarm system, digital communicator and Rescue Assistant System in normal or supervisory (nonalarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode, for a period of 5 hours minimum.
  1. 24 Vdc Secondary (Battery) Power Supplies: Sealed maintenance free lead-calcium battery:
    - a) Ampere-hour capacity to operate under load conditions.
    - b) Meters for battery voltage and charging current.
    - c) Batteries and charger integrally mounted or separate cabinet mounted as recommended by the company producing the system.
  2. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them completely within 4 hours. Charger output is supervised as part of system power fails.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

#### 2.015 WIRE

- A. Wire: Solid-copper conductors with color-coded plenum rated insulation.
  1. Low-Voltage Circuits: No. 18 AWG, minimum for communication circuits and No. 14 AWG minimum for 24v power circuits.
  2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Conductor size shall be as recommended by system manufacturer, except that size shall not be less than specified above.

#### 2.016 TERMINAL STRIP CABINETS (TSC)

- A. Lockable, vandal resistant, surface mounted cabinets constructed of 14 gage steel, size as recommended by the Company producing the system. Equip cabinets with barrier type double screw terminals rated 300V minimum, meeting UL 94 requirements for materials classed 94V-0. Use identification strips, tags or labels to identify each conductor. Paint cabinets red and stencil on front in 1/2 inch high white letters, the purpose of each terminal strip cabinet.

#### 2.017 ACCESSORIES

- A. Provide equipment as required to connect existing fire alarm system addressable loop devices to new system.

#### 2.018 SYSTEM RECORD DOCUMENT CABINET

- B. Provide system record document cabinet with 4GB flash drive, USB B connector, business card holder for key contacts, minimum 2 key ring hooks and 18 gauge steel powder coated red finish with white silk screened 1" high lettering indicating " SYSTEM RECORD DOCUMENTS". Shall accommodate standard 8-1/2" x 11" manuals and loose document records. Manufactured by Space Age Electronics, Inc. Model SRD Ace-11 SSU00689 or approved equal.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not limited to, the following:
  - 1. Factory trained and certified personnel
  - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
  - 3. Personnel licensed or certified by state or local authority.

### 3.02 EQUIPMENT INSTALLATION

- A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department and specified with in.
- B. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.
- C. End of Line Resistors shall be furnished as required four mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
- D. All manual pull stations shall be mounted 48 inches above the finished floor, as measured to the handle.
- E. All audio/visual devices shall be mounted 80 inches above the finished floor, as measured to the lens. Devices shall be mounted no less than 6 inches from the ceiling. All audiovisual devices shall have lexan covers in all areas subject to mechanical damage.
- F. Smoke- or Heat-Detector Spacing:
  - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
  - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
  - 3. Smooth ceiling spacing shall not exceed 24 feet.
  - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A and Appendix B in NFPA 72.
  - 5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- G. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- H. No area smoke or heat detector shall be mounted within 12 inches of any wall. All detectors shall be installed in strict accordance with NFPA 72 (1999) guidelines for such devices.

- I. All mechanical rooms, boiler rooms, gymnasiums, wiring closets, custodian rooms, attic spaces, et. Or areas with no hung ceiling shall be piped with ¾" conduit. All device plenum rated wiring shall be mechanically protected with conduit. All existing areas in public view shall be in metal V-700 wiremold (or equal). All boxes must be painted red and labeled "FIRE ALARM".
- J. All addressable modules shall be mounted within 36 inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, Ansul/Hood subsystems, or door release. Label all addressable modules as to their function.
- K. New door holders shall derive their 24 VAC/VDC power from a separate power supply housed in a dedicated, metal enclosure. The power supply shall have a 120 VAC feed, and is to be centrally located to serve door holders on a per floor or area basis. All existing door holders shall be connected to new FACP. E.C. shall extend all existing wiring in order to make this work. Locations and quantities of door holder power supplies shall be referenced and submitted in the submission package for approved by the Consulting Engineer.
- L. All low voltage wiring terminated to the fire alarm system shall be PLENUM RATED with no exceptions and no less than No. 18 AWG in size, and solid copper.
- M. All line voltage (120 VAC) wiring shall be no less than No. 12 AWG in size, and solid copper. This shall include all system grounding. FACP must have a DEDICATED 20 amp circuit marked back at the power panel NO EXCEPTIONS.
- N. All wiring shall be color-code throughout, to National Electrical Code standards.
- O. Power-limited/non-power-limited NEC wiring standard SHALL BE OBSERVED.
- P. All junction box covers shall be painted federal safety red and labeled FIRE ALARM SYSTEM ONLY in black letters.
- Q. Fire alarm system wiring shall not co-mingle with any other system wiring in the facility. Conduits shall not be shared under any circumstance. Only when fire alarm wiring enters the enclosure of a monitored or controlled system will co-habitation be permitted (i.e. at fan starters or elevator controllers). THIS WILL BE FIELD INSPECTED BY THE PROJECT ENGINEER.
- R. Fire alarm control panel enclosures shall have engraved labels indicating "FIRE ALARM SYSTEM", and the areas of the building served by that panel.
- S. Auxiliary relays shall be appropriately labeled to indicate "FIRE ALARM SYSTEM" and their specific function (i.e. FANS S-1 SHUTDOWN).
- T. All fire alarm wiring shall be continuous and unspliced. Terminations shall only occur at fire alarm devices or control panel enclosures under terminal screws. All other splicing methods are specifically disallowed (i.e. plastic wirenuts).
- U. All fire alarm wiring shall be installed using a dedicated system of supports (i.e. bridle rings). Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility. THIS WILL BE FIELD INSPECTED BY THE PROJECT ENGINEER.
- V. All fire alarm wiring shall be sleeved when passing through any wall, using conduit sleeves (1" min.) with bushings, and fire stopped in accordance with Code.
- W. The system shall be arranged to receive power from one three wire 120 Vac, 20 A supply. All low voltage operation shall be provided from the fire alarm control panel.
- X. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the Contract Drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer. Failure to bring such issues to the attention of the Project Engineer shall be the exclusive liability of the installing Electrical Contractor.
- Y. The existing fire alarm system shall remain in operation unit such time that approval has been granted for its removal. The installing Electrical Contractor shall be responsible for the upkeep of the existing system unit such time that it can be removed.
- Z. The installing Electrical Contractor shall be responsible for the removal of the ENTIRE existing fire alarm system components and controls on the demolition drawing shown or not, upon approval of the AHJ and the Consulting Engineer. The End-User reserved the right to retain any existing fire alarm system components, upon their request. All existing fire alarm system components requiring special handling for disposal (due to radioactivity) shall be the responsibility of the installing contractor. Written proof of proper disposal by the installing contractor shall be required prior to release of outstanding retainage.

- A. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- B. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- C. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- D. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- F. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- G. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
- H. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- I. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.
- J. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- K. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- L. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- M. Make conduit and wiring connections to door release devices, sprinkler flow switches and duct smoke detectors.
- N. Automatic Detector Installation: Conform to NFPA 72.
- O. Ethernet Drop: A standard RJ-45 Ethernet connection to the owner's Ethernet network shall be provided at each fire alarm control unit as part of the contract.

### 3.03 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

### 3.04 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
  2. Smoke dampers in air ducts of designated air-conditioning duct systems.
  3. Alarm-initiating connection to elevator recall system and components.
  4. Supervisory connections at valve supervisory switches.
  5. Supervisory connections at elevator shunt trip breaker.

### 3.05 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.
- E. Ethernet Circuits:
  1. Ethernet circuits shall be provided to the Fire Alarm Control Unit as shown on the plans.
  2. Where a dedicated Fire Alarm Ethernet LAN is specified only Agency Listed Fire Alarm Ethernet hardware shall be installed.
  3. The electrical contractor shall coordinate and ensure proper Ethernet connections occur at the fire alarm control unit and other designated equipment locations prior to system turnover.

### 3.06 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.
- C. Label each device with its corresponding system address.

### 3.07 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### 3.08 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
  - 1. Factory trained and certified.
  - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
  - 3. International Municipal Signal Association (IMSA) fire alarm certified.
  - 4. Certified by a state or local authority.
  - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Inspection:
  - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
  - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests:
  - 1. Perform operational system tests to verify conformance with specifications:
    - a) Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
    - b) Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
    - c) Test Fire Alarm Control Unit and Remote Annunciator.
  - 2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.

H. Final Test, Record of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.010 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.011 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26.
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING: Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

1.1 FIELD QUALITY CONTROL

- A. The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the function as specified.
- B. The installing contractor or fire alarm equipment vendor shall have no less than two (2) NICET Level II fire alarm technicians dedicated to this project.
- C. The Installing Contract and the Fire Alarm System Vendor shall, upon the request of the Consulting Engineer or End-User, attend any and all project meeting for the purpose of accurately determining progress.
- D. It shall be the responsibility of the installing contractor to assure that construction debris does not adversely affect any sensing devices installed as part of this project. Should it be deemed necessary by the Consulting Engineer, End-User or AHJ, the installing contractor shall be responsible for the cleaning of all smoke detectors prior to final acceptance.

1.2 DOCUMENTATION AND TRAINING

- A. The contractor shall compile and provide to the owner three (3) complete manual on the completed system to include SITE SPECIFIC operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list. An operational Video, on DVD media, shall also be included.

- B. In addition to the above manuals, the Electrical Contractor shall provide the services of the manufacturer's trained representative for two (2) separate calendar days for a period of four (4) hours per day to instruct the owners' designated personnel on the operation and maintenance of the entire system.
- C. As-built drawings shall consist of the following:
  - 1. Complete revision of all previously submitted drawings.
  - 2. Point-to-point depiction of all device wiring on the device layout floor plans.
  - 3. One (1) set of B-size, laminated as-built drawings.
  - 4. Two (2) sets of 30" x 42" inch 1/16"-1' scale drawings showing all points of fire alarm. One set shall be submitted with the close-out documents. Second set shall be mounted in frame with a Lexan cover. These drawings must be submitted to the project Engineer for approval.
- D. Turnover of all software database hard/soft copies shall be required. This shall include all possible programming software logs, diskettes or CDs containing exported project files, hard copies of all device maps, the revision number of the version of programming utility used, and all required passwords. The turnover of all database information shall occur prior to the end of the one (1) warranty period (or period as amended earlier in this specification).

### 3.5 Tests and Inspections:

- 1. Visual Inspection: Conduct visual inspection prior to testing.
  - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
  - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
- 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
- 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
- 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
- 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- A. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- B. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.



- D. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- E. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.012 EVALUATION CRITERIA

#### A. The proposal response will be evaluated based upon the following best value criteria:

- |  |           |
|--|-----------|
| 1. Ability to Meet RFP Requirements        | 5 Points  |
| 2. Thoroughness of Response                | 10 Points |
| 3. Design Capabilities                     | 10 Points |
| 4. Product Capabilities                    | 10 Points |
| 5. References                              | 5 Points  |
| 6. Warranty and Service Support Capability | 10 Points |
| 7. Staffing Approach                       | 5 Points  |
| 8. Scope of Work                           | 5 Points  |
| 9. Safety Approach                         | 5 Points  |
| 10. Training Capability                    | 5 Points  |
| 11. Quality Assurance                      | 5 Points  |
| 12. Manufacturing Capacity                 | 5 Points  |
| 13. Disaster Recovery Plan                 | 5 Points  |
| 14. Central Monitoring Capability          | 5 Points  |
| 15. Cost                                   | 10 Points |

#### B. Executive Summary

- 1. The system vendor shall provide an overview of their company. The summary should also include additional information demonstrating how your product and services are differentiated from the competition. Please include a one-page overview of the company including a summary of the ownership of the company.

#### C. Design Capability

- 1. The system vendor shall demonstrate capabilities to provide fire alarm system design services in the local area. The overview should include a summary of CAD resources and project configuration management techniques. New product development capabilities shall be demonstrated and a list of patent innovations is requested.

#### D. System Overview

- 1. The system vendor shall provide a system overview for the proposed fire alarm equipment. Please include features and functions of the proposed:
  - a) Fire Alarm Network
  - b) Fire Alarm Panels

- c) Graphic User Interface (GUI)
  - d) Initiating devices
  - e) Notification devices
- 2. The system vendor shall detail other systems the proposed fire alarm system is capable of integrating to.
- 3. The system vendor shall detail the fire alarm systems network diagnostic capability.
- 4. The system vendor shall describe recent fire alarm technology that can contribute to project installation cost savings, service efficiency, and ensure the highest levels of survivability.
- E. References
  - 1. The system vendor shall provide four references. References must include equipment similar to the requirements included in this solicitation.
- F. Warranty/Service Availability
  - 1. The system vendor shall explain their local warranty and service capability that's available from the system vendor's local office. Warranty and Service Information shall include:
    - a) Preventative Maintenance
    - b) Local Trained Technicians
    - c) Repair Parts
    - d) A Strategy for resolving system malfunctions during business hours, non-business hours, and weekends
    - e) A Process of tracking service calls and escalation of recurring problems.
- G. Staffing and Management
  - 1. The system vendor shall provide a description of their local office personnel.
  - 2. The system vendor shall describe their local Project Management capability, Service and Installation Personnel.
  - 3. The system vendor shall describe additional resources (i.e. Corporate, Manufacturing, Quality Assurance Resources).
- H. Scope of Work
  - 1. The system vendor shall describe their design and phasing approach on this fire alarm system upgrade project. Please describe your system design, project management approach, professional installation services, and technical installer support. Also, include a fire alarm system test procedure.
- I. Safety
  - 1. The system vendor shall explain why safety is important on this type of installation project. The system vendor shall appoint an accountable safety foreman on this project. An overview of a safety plan must be described.
- J. Training
  - 1. The system vendor shall demonstrate their ability to meet both on-site and off-site fire alarm operation and maintenance training.
- K. Quality Assurance/Quality Control Plan
  - 1. The system vendor shall provide a Quality Assurance/Quality Control Plan.

2. Please provide the name of the project's site foreman and describe their assigned project responsibilities. The assigned foreman must be NICET certified for the installation and maintenance of fire alarm systems.
3. Please explain how quality is implemented in both Project Management and Technical Installation Support on this project. The system vendor shall provide start-up procedures, construction procedures, and close-out procedures for this fire alarm system upgrade project.
4. The system vendor's processes must be ISO 9001 and ISO 9002 compliant. The seller shall provide their UL Certificate of Registration.
5. Please explain how defect prevention is conducted both in your manufacturing facility as well as with your existing fire alarm customers.
6. Please describe how Software Quality Assurance (SQA) and product life cycle development work together in the various stages of a new product.
7. The system vendor must demonstrate two problem-solving examples that show how their field office and the seller's headquarter manufacturing personnel work together to solve a fire alarm issue.

L. Manufacturing Capacity

1. The system vendor shall explain an overview of their manufacturing capability.
2. The system vendor shall explain the technology used to manufacture and test small systems, large systems and high volume peripherals. In addition the system vendor shall provide an overview of additional manufacturing conducted at the facility.
3. The system vendor shall describe the facilities' throughput capacity on manufactured Printed Circuit Assemblies (PCA).
4. The system vendor shall provide a layout of the manufacturing facility and include graphics of selected manufacturing equipment in the factory.

M. Disaster Recovery Plan

1. The system vendor shall provide a description of their disaster recovery plan, including an example of how the plan was followed during an actual disaster situation.

N. Cost

1. The system vendor shall provide a complete turnkey price for design/build and installation of a retrofit fire alarm system.

O. Central Monitoring

1. The system vendor shall provide around the clock electronic monitoring for trouble and alarm conditions. Please describe the process used to notify agencies and/or individuals if a condition occurs. Note any value added features such as redundancy or technology enhancements.

P. Security Integration to the Proposed Fire Alarm System

1. The system vendor shall provide an optional overview of a security access control platform that integrates to the proposed fire alarm system. The system vendor shall describe the variety of network solutions that are available for this security platform (i.e. dedicated fault tolerant network, Ethernet Network, Wide Area Network.)

END OF SECTION 283101



## SECTION 310000 – EARTHWORK

### PART 1 - GENERAL

#### 1.01 Earthwork:

##### A. Scope of Work:

1. The General Contractor shall be responsible for the excavation required to install foundations and shall include any site work needed to allow equipment access to the site and preparation of the site for equipment.
2. Excavation and backfill required to install utilities (water, gas, electric, etc.), sanitary plumbing lines and connection to existing sanitary line, installation of electrical line in buried electrical conduit, installation of buried water service line, roof drain and stormwater piping.
3. Preparation of subgrade for building slabs, walks, stairs, footings, and pavements as per drawings.
4. Excavation and backfill required to install new manholes, storm pipe, and roof drains.
5. Backfilling and site restoration to return the area to conditions as they were at the beginning of the job.
6. Excavation shall be done in a manner to minimize the disruption of the services and access to the various parts of the site.
7. Excavated material that is not to be used for backfilling or is unsuitable for backfill shall be removed from the site. It is the responsibility of the contractor to properly remove, haul, and dispose of same.
8. Asphalt pavement and deleterious fill shall be removed off site and properly disposed of.
9. Contractor shall secure all of his equipment at the end of each work day.
10. Installation of storm sewer structures and piping.
11. Site staging area set up including construction fence and temporary stone base.
12. Site restoration.
13. Recycled Concrete Aggregate/Recycled Asphalt Pavement: The use of recycled concrete aggregate or recycled asphalt pavement, or any blend of these materials, with or without soil or quarry process stone shall not be permitted.

##### B. Quality Assurance:

1. Safety Codes and Standards: Perform earthwork and site grading work in compliance with the applicable requirements of governing authorities having jurisdiction.

Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, tenants, the public, materials, etc. Barricades where applicable shall conform with all the local codes and regulations and shall be removed upon completion of the contract.

The Contractor shall be solely responsible for stability of excavation and shall provide all sheathing, lagging, bracing, etc., required to retain the excavations and to prevent slides sloughs.

C. Job Conditions:

1. Testing and Inspection Service: Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

D. Submittals: The contractor shall notify the Engineer/architect of the source of fill material to be used. The equipment to be used, the date and time that earthwork operations will start and the name of the person who will be in charge of the operations in the field.

E. Test Reports - Excavating: Submit following reports directly to Engineer from the testing services, with copy the Contractor:

1. Test reports on borrow material.
2. Verification of each footing subgrade.
3. Field density test reports.
4. One optimum moisture - maximum density curve for each type of soil encountered.
5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

F. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities.

Care shall be taken not to move, without the consent of the proper parties, any water or gas pipes, valve boxes, culverts, telegraph, telephone or electric piles, or wires, conduits or other structures or appurtenances, and where interfered with by the work they shall be supported securely in place until the work is complete, and shall be so treated as to render their condition safe and permanent as before. If so directed by the Architect, the location of any existing structures or work shall be changed to meet the requirements of the conditions encountered and leave all in good working order, at no extra cost to the owner.

If any water or gas mains, valve boxes, telephone conduits, drains and other existing structures are broken, injured or caused to leak by reason of the construction of the

sewer or any part thereof, the Contractor shall give immediate notice to the proper parties having such structures in charge, and such parties shall cause such leaks, breaks, or injury to be repaired. If any house connections to the water mains shall become broken or damaged during the construction, they shall be immediately repaired by such parties. The expense of such work shall be paid by the Contractor.

G. Use of Explosives: The use of explosives is not permitted.

H. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

I. Products:

1. Soil Materials - Definitions:

- a. Satisfactory soil materials are defined as those complying with the American Association of State Highway and Transportation Officials (AASHTO) soil classification groups A-1, A-2-4, A-2-5 and A-3.
- b. Unsatisfactory soil materials are defined as those complying with AASHTO for soil classification groups A-2-6, A-2-7, A-4, A-5, A-6 and A-7, also, peat and other highly organic soils and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1% below and 3% above the optimum moisture content of the soil material, as determined by moisture-density relations test.
- c. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand as specified on drawings or herein in layers of specified thickness.
- d. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.
- e. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

J. Execution:

1. Excavation: Work includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Remove all deleterious material and materials unacceptable to the Engineer.

All existing rooty organic topsoil, uncompacted fill material, and peat must be removed from within the building and extending five feet beyond the building lines.

All layers of virgin soil directly beneath the peat or fill which are obviously loose or soft, whether due to the presence of roots, frost disturbance, or other causes, must either be removed or recompact in place depending upon root content, layer thickness, or other pertinent factors, as directed by the Engineer.

Excavated material, free from deleterious matter, may be used to grade areas around the buildings but shall not be reused for fill beneath floor slabs. All excess or unsuitable excavated material shall be disposed of by the Contractor in an approved off-site disposal area provided by the contractor. Should additional fill be required to meet final grade elevations, the contractor shall deliver to the site appropriate fill as part of his contract with no additional cost to the owner.

Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation. Any abandoned utility lines encountered during any and all excavation shall be removed in its entirety.

Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 3.4 cubic yard (heaped) capacity backhoe. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.

Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping.

Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock- hard cementitious aggregate deposits.

Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of materials encountered will be classified as earth excavation.

Rock payment lines are limited to the following:

Two feet outside of concrete work for which forms are required, except footings.

One foot outside perimeter of footings.

In pipe trenches, 6" below invert elevation of pipe and 2 ft. wider than inside diameter of pipe, but not less than 3 ft. minimum trench width.

Neat outside dimensions of concrete work where no forms are required.

Under slabs on grade, 6" below bottom of concrete slab.

Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.



Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Clean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

- a. Additional Excavation: When excavation has reached required subgrade elevations notify Engineer who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Engineer

Removal of unsuitable material and its replacement as directed will be part of base contract. No extra will be paid for any additional excavation.

- b. Stability of Excavations: Slope sides of excavations to comply with OSHA, local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

- c. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.  
Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

- d. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess soil material and waste materials as herein specified.

- e. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms required lines and grades to leave solid base to receive other work. Excavation for footing and foundations shall be to virgin soil. Any existing foundations or other concrete work discovered during excavation shall be completely removed.

In excavating for footings and foundations, the presence of fill shall be completely removed and replaced with selected fill. Excavate to a depth of 4' below existing grade.

- f. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.
- g. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

For pipes or conduit 6" or larger in nominal size, and electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.

Except as otherwise indicated, excavate for exterior water-bearing piping (water drainage) so top of piping is not less than 3' below finished grade.

Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of

pipng or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

- h. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

2. Compaction:

- a. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification.
- b. Percentage of Maximum Density Requirements: Compact soil to not less than the allowing percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
- c. Structures, Building: Slabs and Steps, Pavements: Compact top 12" of sub-grade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.
- d. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relatively density for cohesionless soils.
- e. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relatively density for cohesionless material.
- f. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3. Backfill and Fill:

- a. General: All areas to receive fill shall be leveled. The surface shall be free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment utilized. If placed, the stone drainage blanket shall consist of 3/4" size crushed stone and be uniformly spread over the bottom of the excavation. The average thickness of the drainage blanket shall be 15". Sump pits shall be set as

required to control the water level in the blanket. Pumps shall be used to maintain the water level a minimum of 12" below the surface of the fill. Material for controlled fill in building areas and extending five feet beyond the building limits shall preferably consist of clean sand and/or gravel, free of vegetable matter or other deleterious substances. The sand and/or gravel shall be well graded and shall contain no more than 70% by weight of material finer than the No. 30 sieve and no more than 15% by weight of material finer than the No. 200 sieve. Boulders and cobbles having a maximum diameter exceeding six inches shall be excluded from the fill material. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, use satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

Under walks and pavements, use subbase material.

Under steps, use subbase material.

Under building slabs, use drainage fill material.

Under piping and conduit, use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 90° of cylinder.

Underground electrical conduit, encase the conduit in 1' of white sand.

Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing and perimeter insulation.

Inspection, testing, approval, and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

Removal of trash and debris.

- b. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground

surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

- c. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density floor each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

The surface of the fill shall be kept at a slight slope to facilitate drainage of any ground or surface water which enters the excavation. Sump pits and pumps shall be used, if required, to maintain the fill in a reasonably dry condition.

After each layer has been placed and spread evenly, it shall be thoroughly compacted to an average value of 95% of the maximum Modified Proctor density of the soil being utilized within the building areas and extending five feet beyond the building limits in all directions. No individual test values shall be acceptable if they are below 90%. If required, the maximum density of the material shall be determined by a Soils Engineer in accordance with the American Society for Testing and Materials (ASTM) D 1557, latest edition. Cost for testing will be borne by the contractor at no additional cost to the owner.

A smooth-wheeled vibratory compactor should provide the most suitable means of compaction of essentially non-cohesive granular soils. Small, portable rammer or vibratory plate compactors should be utilized within five feet of existing walls.

Sufficient passes of approved compactor shall be made in order to obtain the specified densities. A minimum of three passes of the compactor shall be required over all portions of each lift. A "pass" shall be defined as one passage of the contact portion of the compactor over the entire surface of the layer.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

#### 4. Grading:

- a. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

- b. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes, and as follows:

- c. Lawn or Unpaved Areas: Finish areas to receive topsoil to within no more than 0.10' above or below required subgrade elevations.
- d. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required subgrade elevation.
- e. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.
- f. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.
- g. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

5. Pavement Sub-Base Course:

- a. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.
- b. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- c. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of subbase course.
- d. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

6. Field Quality Control:

- a. Quality Control Testing During Construction: Allow testing service of inspect and approve subgrades and fill layers before further construction work is performed.

Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.

- b. Footings Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Engineer.
- c. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.
- d. Foundation Wall Backfill: Take at least 2 field density tests, at locations and elevations as directed.

If, in the opinion, of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

7. Maintenance:

- a. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.  
  
Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- b. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- c. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

8. Disposal of Excess and Waste Materials:

- a. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION 310000





## SECTION 311000 – SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities.
6. Temporary erosion- and sedimentation-control measures.

- B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
2. Section 017300 "Execution" for field engineering and surveying.
3. Section 017419 "Construction Waste Management and Disposal."
4. Section 024119 "Selective Demolition" for partial demolition of buildings or structures.

#### 1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- D. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch (25-mm) blue vinyl tie tape flag around each tree trunk at 54 inches (1372 mm) above the ground.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

### 3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

### 3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  - 1. Limit height of topsoil stockpiles to 72 inches.
  - 2. Do not stockpile topsoil within protection zones.
  - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

### 3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

### 3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

## SECTION 312000 – EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for pavements and turf and grasses.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete pavements.
5. Subbase course and base course for asphalt paving.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

#### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: All removal of material encountered shall be included in the base bid for this contract.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  - 1. Warning tapes.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 1557.

#### 1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

- B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.
- D. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- E. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- F. Do not direct vehicle or equipment exhaust towards protection zones.
- G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 15 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.
- I. Sand: ASTM C 33/C 33M; fine aggregate.
- J. Recycled Concrete Aggregate (RCA) from offsite borrow facilities shall not be allowed.

## 2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.



1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
  - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
  - a. 24 inches outside of concrete forms other than at footings.
  - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - c. 6 inches beneath bottom of concrete slabs-on-grade.
  - d. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

### 3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
  1. Clearance: 12 inches each side of pipe or conduit.

- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
  - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
  - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
  - 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.7 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph .
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.8 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring, bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Initial Backfill:
  - 1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1-1/2 inch in any dimension, to a height of 6 inches over the pipe or conduit.
    - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Final Backfill:
  - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### 3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
  - 2. Pavements: Plus or minus 1/2 inch.

### 3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Place base course material over subbase course under hot-mix asphalt pavement.
  - 2. Shape subbase course and base course to required crown elevations and cross-slope grades.

3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  1. Place drainage course 6 inches or less in compacted thickness in a single layer.
  2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557

### 3.16 FIELD QUALITY CONTROL

- A. Special Inspections: The Owner will engage a qualified special inspector to perform the following special inspections:
  1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  2. Determine that fill material classification and maximum lift thickness comply with requirements.
  3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: The Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Building Areas: Minimum of 4 tests per fill lift; spacing not to exceed 50' between test locations.
  - 2. Parking/Roadway Areas: Minimum of 3 tests per fill lift; spacing not to exceed 100 feet between test locations.
  - 3. Trench Backfill: At each compacted fill layer, at least one test for every 150 feet of trench length but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

## SECTION 312319 – DEWATERING

### PART 1 – GENERAL

#### 1.1 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, tools and appurtenances required to remove and dispose of all surface and ground water entering excavations and to permit construction to be performed in the dry, as shown on the Contract Drawings and specified herein.

#### 1.2 RELATED SECTIONS

- A. Division 31, Section 312000, Earth Moving

#### 1.3 QUALITY ASSURANCE

- A. Carefully examine the site and all available documentation to determine potential hazards to existing structures and natural features.
- B. Do not begin any dewatering operations without the prior approval of the Owner.

#### 1.4 SUBMITTALS

- A. The Contractor shall submit a dewatering system design for review and approval by the Engineer, which shall include drawings with calculations and written descriptions of the proposed equipment, materials and procedures. All dewatering system design documents shall be submitted at least 2 weeks prior to starting work.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Piping, pumping equipment, sump and trench installation and other materials required to provide dewatering of excavations shall be suitable for the intended purpose. Back-up pumping units shall be maintained at the site to be used in case of failure of the normal pumping units.

### PART 3 – EXECUTION

#### 3.1 DEWATERING SYSTEM

- A. Maintain proper equipment, facilities and personnel to remove all water entering excavations during the construction period.

- B. Control the groundwater level and the piezometric level at a minimum depth of 3 feet below excavation level.
- C. Provide a standby power system and redundant power supply lines for each pump designed to turn on automatically when the primary power source is interrupted.
- D. Perform dewatering in manner to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Construct well or sump installations with proper sand filters to prevent removal of fine grained soil from the surrounding ground.
- E. Collect water entering the excavation from surface runoff in shallow ditches around the perimeter of the excavation, drain to sumps and pump from the excavation to maintain a bottom free from standing water.
- F. Dispose of drainage so that flow or seepage back into the excavated area will be prevented.
- G. Contractor shall be responsible for complying with all applicable local, state, and federal regulations and requirements related to dewatering, including but not limited to the Departments of Environmental Protection and Conservation. Contractor shall also be responsible for obtaining any regulatory approvals necessary for dewatering.

### 3.2 MAINTENANCE

- A. The Contractor shall be responsible for the maintenance, servicing, repairs, make additions, changes, or replacements to provide a satisfactory system, at no additional cost to the Owner.
- B. If there is a total failure of the dewatering system, the Contractor shall flood the excavation.
- C. If the dewatering requirements are not satisfied due to a failure of the dewatering system, the Owner determines that the subgrade has been damaged, the Contractor shall be responsible for the removal and replacement of the affected soils.
- D. Accomplish dewatering without damaging existing structures adjacent to excavation.

### 3.3 FLOOD PROTECTION

- A. Provide the work area with adequate protection against floods.
- B. If an excavation is flooded as an emergency procedure, the Contractor shall restore the work area and repair all damage caused by the flooding at no additional cost to the Owner.

### 3.4 REMOVAL OF DEWATERING SYSTEM

- A. Remove all elements of the dewatering system at the conclusion of the construction phase, and restore the site to its natural condition, and as directed by the Owner.

END OF SECTION 312319



## SECTION 313117 – SOIL CONSERVATION

### PART 1 - GENERAL

1.01 Description of Work: The extent of the soil conservation work is shown on the drawings and schedules. Sediment fence details, inlet filter details, construction sequence, and seeding schedules required are shown on the drawings.

The contractor shall comply with all soil erosion and sediment control practices in accordance with the "New York State Standards and Specifications for Erosion and Sediment Control", and as directed by the local Soil Conservation District representative and the architect.

END OF SECTION 313117



## SECTION 315000 – EXCAVATION SUPPORT AND PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
  - 2. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

#### 1.4 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
  - 1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

### 3.2 SOLDIER PILES AND LAGGING

- A. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- B. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.3 FIELD QUALITY CONTROL

- A. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- B. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.4 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 1. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
  - 2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000



## SECTION 321216 – ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Hot-mix asphalt paving.
- B. Related Requirements:
  - 1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
  - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Standard Specification of New York Department of Transportation for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Cement: ASTM D 3381/D 3381M for viscosity-graded material.
- B. Water: Potable.

### 2.3 AUXILIARY MATERIALS

- A. Sand: AASHTO M 29, Grade No. 2 or No. 3.

### 2.4 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  2. Base Course: Mix I-2.
  3. Surface Course: Mix I-5.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.



- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.

### 3.3 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  - 2. Place hot-mix asphalt surface course in single lift.
  - 3. Spread mix at a minimum temperature of 250 deg F.
  - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
  - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.4 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent or greater than 100 percent.
  - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.6 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch.
  - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch
  - 2. Surface Course: 1/8 inch
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.8 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in General Conditions.

END OF SECTION 321216

## SECTION 321313 – CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321723 "Pavement Markings."

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:
  - a. Concrete mixture design.
  - b. Quality control of concrete materials and concrete paving construction practices.
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
  - a. Contractor's superintendent.
  - b. Independent testing agency responsible for concrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Concrete paving Subcontractor.
  - e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.6 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
  - B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
    1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- 1.7 FIELD CONDITIONS
- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
  - B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
    1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
    2. Do not use frozen materials or materials containing ice or snow.
    3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
  - C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
    1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    2. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

### 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. **[Do not use notched and bent forms.]**
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.3 STEEL REINFORCEMENT

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 10 percent.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
- E. Water: Potable and complying with ASTM C 94/C 94M.

## 2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

## 2.6 CURING MATERIALS

- A. Water: Potable.
- B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

## 2.7 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

## 2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- E. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- F. Concrete Mixtures: Normal-weight concrete.
  - 1. Compressive Strength (28 Days): 4000 psi.
  - 2. Maximum W/C Ratio at Point of Placement: 0.45.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.

## 2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below **concrete paving** to identify soft pockets and areas of excess yielding.



1. Completely proof-roll subbase in one direction **and repeat in perpendicular direction**. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  2. Provide tie bars at sides of paving strips where indicated.
- C. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation **steel reinforcement** and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface **and steel reinforcement** before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies [, **reinforcement**,] or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.

- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

### 3.8 DETECTABLE WARNING INSTALLATION

- A. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with ADA requirements.

### 3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by curing compound as follows:
  - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.10 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
  - 1. Elevation: 3/4 inch.
  - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  - 3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
  - 4. Joint Spacing: 3 inches.
  - 5. Joint Width: Plus 1/8 inch, no minus.

### 3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

### 3.12 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313



## SECTION 321614 – CONCRETE SITE WORK

### PART 1 - GENERAL

1.01 General: All concrete work (material & construction procedure) shall be in accordance with ACI Standard 318-83 (R-86). Contractor shall perform all concrete work above and below grade as indicated on the drawings and as required.

Concrete shall be capable of developing minimum compressive strength of 4,000 psi at 28 days.

Add air entraining agency maximum 5% by volume to exposed concrete mix (ASTM C 260).

This work shall include any items for the construction of the retaining wall, sidewalk, and concrete curb.

1.02 Quality Assurance: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

Materials and installed work may require testing and retesting, as directed by Architect, at anytime during progress of work. Allow free access to materials stockpiles and facilities. Tests, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

#### 1.03 Form Materials:

1. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct form work for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. . Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

Use overlaid plywood complying with U.S. Product Standard "A-C or High Density Overlaid Concrete Form", Class 1.

2. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

#### 1.04 Concrete Materials:

Portland Cement: ANSI/ASTM C 150, Type I. Use one brand of cement throughout project.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Water: Drinkable.

#### 1.05 Related Materials:

Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints and other joints as shown. Size to suit joints.

Rubber Waterstops: Corps of Engineers CRD-C 513.

Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

Waterproof paper.  
Polyethylene film.  
Polyethylene-coated burlap.

1.06 Proportioning and Design of Mixes: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

4,000 psi 28-day compressive strength; W/C ratio, 0.44 maximum (non- air-entrained), 0.35 maximum (air-entrained).

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 3".

Reinforced foundation systems: Not less than 1-1/2" & not more than 3".

Other concrete: Not more than 4".

#### 1.07 Concrete Mixes:

Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2. minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, and as herein specified.



During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ANSI/ASTM C 94 may be required.

When air temperature is between 85° F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

Concrete Coloring Systems: Concrete coloring systems shall be Chromix admixtures; L.M. Scofield Company for main areas as shown on the drawings and Lithotex Colorstone; L.M. Scofield Company for accent areas as shown on the drawings. Admixtures shall conform to ASTM C 494, AASHTO M 194 and CRD C 87, and ASTM C 979 as coloring agents.

1.08 Forms: Design, erect, support, brace and maintain form work to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation and position.

Design form work to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, regrets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, regrets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.

Provisions for Other Trades: Provide openings in concrete form work to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

1.9 Joints:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Form contraction joints by inserting pre-molded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

1.10 Preparation of Form Surfaces: Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

1.11 Concrete Placement: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

Comply with ACI 304 and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning flashing operations.

Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Wet forms thoroughly before placing concrete.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

1.12 Finish of Formed Surfaces: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise imparted by form indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height -rubbed down or chipped off.

At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

1.13 Monolithic Slab Finishes: Reserved

1.14 Concrete Curing & Protection: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

Curing Methods: Perform curing of concrete by. moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound.

1.15 Removal of Forms: Form work not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50° F. (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

1.16 Re-Use of Forms: Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new form work.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove f-ins and laitance, and tighten forms to close joints. Align and secure joint- to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

1.17 Miscellaneous Concrete Items: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

Grout base plates and foundations as indicated, using specified non-shrink grout. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

1.18 Concrete Surface Repairs:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms.

Cut out honeycomb, rock pockets, voids over ¼" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, stains, air bubbles, honeycomb, rock pockets; f-ins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out from tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified.

Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01' wide or -which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2 ½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Architect.

1.19 Quality Control Testing During Construction: Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens.
3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C), and above; and each time a set of compression test specimens made.
4. Compression Test Specimen: ASTM C 31; one set of 6 standard cylinders or each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

END OF SECTION 321614

## SECTION 321723 – PAVEMENT MARKINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes painted markings applied to asphalt pavement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Standard Specifications of the Department of Transportation for pavement-marking work.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, and not exceeding 95 deg F.

### PART 2 - PRODUCTS

#### 2.1 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.
  - 1. Color: white, yellow, and blue.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect. Pavement marking includes but not limited to: parking stall, traffic marking, and outdoor playground game lines striping.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723



## SECTION 323113 – CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Chain-link fences.
  - 2. Gates: swing.
- B. Related Sections:
  - 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
  - 1. Fence and gate posts, rails, and fittings.
  - 2. Chain-link fabric, reinforcements, and attachments.
  - 3. Accessories: Insert accessory.
  - 4. Gates and hardware.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For components with factory-applied color finishes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 1 year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
  1. Fabric Height: As indicated on Drawings.
  2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
    - a. Mesh Size: 2 inches.
    - b. Polymer-Coated Fabric: ASTM F 668, Class 1 over zinc-coated steel wire.
      - 1) Color: Black, complying with ASTM F 934.
  3. Selvage: Knuckled at both selvages.

### 2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
  1. Fence Height: As indicated on Drawings.
  2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
    - a. Line Post: As indicated on the drawings.
    - b. End, Corner and Pull Post: As indicated on the drawings.
  3. Horizontal Framework Members: top and bottom rails complying with ASTM F 1043.
    - a. Top Rail: As indicated on the drawings.
  4. Brace Rails: Comply with ASTM F 1043.
  5. Metallic Coating for Steel Framing:
    - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.

## 2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.177-inch diameter, tension wire complying with ASTM F 1664, Class 1 over zinc-coated steel wire.
  - 1. Color: Match chain-link fabric as selected by Owner from manufacturer's full range, complying with ASTM F 934.

## 2.4 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Rail and Brace Ends: For each gate, corner, pull, and end post.
- C. Rail Fittings: Provide the following:
  - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
- D. Tension and Brace Bands: Pressed steel.
- E. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- F. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    - a. Hot-Dip Galvanized Steel: 0.148-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- G. Finish:
  - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
    - a. Polymer coating over metallic coating.
  - 2. Aluminum: Mill finish.

## 2.5 GROUT AND ANCHORING CEMENT

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

### 3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

### 3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated in firm soil or compacted backfill.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil or compacted backfill.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 5' o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
  - G. Intermediate and Bottom Rails: Install and secure to posts with fittings.
  - H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
  - I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
  - J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
    1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
  - K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

### 3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.6 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113



## SECTION 323215 – PRECAST MODULAR BLOCK GRAVITY RETAINING WALL

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. This Section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) retaining wall without geosynthetic reinforcement. Precast modular block retaining wall blocks under this section shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 1,000 pounds (450 kg) per unit.
- B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.
- C. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 31, Division 32 and Division 33 also apply to this Section.

#### 1.02 PRICE AND PAYMENT PROCEDURES

- A. Allowances. No allowance shall be made in the price of the retaining wall for excavation beyond the limits required for retaining wall construction as shown on the project plans. The cost of excavation for the purposes of site access shall be the responsibility of the General Contractor. Removal of unsuitable soils and replacement with select fill shall be as directed and approved in writing by the Owner or Owner's representative and shall be paid under separate pay items.
- B. Unit Prices. In addition to a lump sum price pursuant to completion of the scope of work described in Part 1.01 of this Section, the General Contractor shall provide a unit price per square foot of vertical wall face that shall be the basis of compensation for up to a ten (10) percent increase or reduction in the overall scope of the retaining wall work.
- C. Measurement and Payment.
  - 1. The unit of measurement for furnishing the precast modular block retaining wall system shall be the vertical area of the wall face surface as measured from the top of the leveling pad to the top of the wall including coping. The final measured quantity shall include supply of all material components and the installation of the precast modular block retaining wall system.
  - 2. The final accepted quantities of the precast modular block retaining wall system will be compensated per the vertical face area as described above. The quantities of the precast modular block retaining wall as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per square foot of vertical wall face.

#### 1.03 REFERENCES

- A. Where the specification and reference documents conflict, the Owner's designated representative will make the final determination of the applicable document.

B. Definitions:

1. Precast Modular Block (PMB) Unit – machine-placed, “wet cast” concrete modular block retaining wall facing unit.
2. Geotextile – a geosynthetic fabric manufactured for use as a separation and filtration medium between dissimilar soil materials.
3. Drainage Aggregate – clean, crushed stone placed within and immediately behind the precast modular block units to facilitate drainage and reduce compaction requirements immediately adjacent to and behind the precast modular block units.
4. Unit Core Fill – clean, crushed stone placed within the hollow vertical core of a precast modular block unit. Typically, the same material used for drainage aggregate as defined above.
5. Foundation Zone – soil zone immediately beneath the leveling pad.
6. Retained Zone – soil zone immediately behind the drainage aggregate and wall infill for wall sections designed as modular gravity structures.
7. Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks are placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.
8. Wall Infill – the fill material placed and compacted between the drainage aggregate and the excavated soil face in retaining wall sections designed as modular gravity structures.

C. Reference Standards

1. Design
  - a. AASHTO LRFD Bridge Design Specifications, 7<sup>th</sup> Edition, 2014.
  - b. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-10.
  - c. International Building Code, 2015 Edition.
  - d. Design Manual for Segmental Retaining Walls, National Concrete Masonry Association, 3<sup>rd</sup> Edition, 2010
2. Precast Modular Block Units
  - a. ACI 201 – Guide to Durable Concrete
  - b. ACI 318 – Building Code Requirements for Structural Concrete
  - c. ASTM C33 – Standard Specification for Concrete Aggregates
  - d. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - e. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
  - f. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - g. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
  - h. ASTM C150 – Standard Specification for Portland Cement
  - i. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - j. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
  - k. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
  - l. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
  - m. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - n. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
  - o. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
  - p. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
  - q. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
  - r. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.



- s. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
  - t. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
  - u. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
  - v. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
  - w. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.
  - x. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).
  - y. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).
3. Geosynthetics
- a. AASHTO M 288 – Geotextile Specification for Highway Applications.
  - b. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method.
  - c. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.
  - d. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles
  - e. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - f. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  - g. ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - h. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - i. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - j. ASTM D4759 – Standard Practice for Determining Specification Conformance of Geosynthetics.
  - k. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
  - l. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
  - m. ASTM D6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
4. Soils
- a. AASHTO M 145 – AASHTO Soil Classification System.
  - b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
  - c. AASHTO T 267 – Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition.
  - d. ASTM C33 – Standard Specification for Concrete Aggregates.
  - e. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
  - f. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
  - g. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).
  - h. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
  - i. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

- j. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).
  - k. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  - l. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
  - m. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
  - n. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
  - o. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - p. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
  - q. ASTM D4972 – Standard Test Method for pH of Soils.
  - r. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).
  - s. ASTM G51 – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.
  - t. ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.
5. Drainage Pipe
- a. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - b. ASTM F2648 – Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preconstruction Meeting. As directed by the Owner, the General Contractor shall schedule a preconstruction meeting at the project site prior to commencement of retaining wall construction. Participation in the preconstruction meeting shall be required of the General Contractor, Retaining Wall Design Engineer, Retaining Wall Installation Contractor, Grading Contractor and Inspection Engineer. The General Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.
1. Preconstruction Meeting Agenda:
- a. The Retaining Wall Design Engineer shall explain all aspects of the retaining wall construction drawings.
  - b. The Retaining Wall Design Engineer shall explain the required bearing capacity of soil below the retaining wall structure and the shear strength of in-situ soils assumed in the retaining wall design to the Inspection Engineer.
  - c. The Retaining Wall Design Engineer shall explain the required shear strength of fill soil in the retained and foundation zones of the retaining wall to the Inspection Engineer.
  - d. The Retaining Wall Design Engineer shall explain any measures required for coordination of the installation of utilities or other obstructions in the retained fill zones of the retaining wall.
  - e. The Retaining Wall Installation Contractor shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Grading Contractor.

## 1.05 SUBMITTALS

- A. Product Data. At least 14 days prior to construction, the General Contractor shall submit a minimum of six (6) copies of the retaining wall product submittal package to the Owner's Representative for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:
1. Precast Modular Block System brochure
  2. Precast Modular Block concrete test results specified in paragraph 2.01, subparagraph B of this section as follows:
    - a. 28-day compressive strength
    - b. Air content
    - c. Slump or Slump Flow (as applicable)
  3. Drainage Pipe
  4. Geotextile
- B. Installer Qualification Data. At least 14 days prior to construction, the General Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the Retaining Wall Installation Contractor, per paragraph 1.07, subparagraph A of this section.
- C. Retaining Wall Design Calculations and Construction Shop Drawings. At least 14 days prior to construction, the General Contractor shall furnish six (6) sets of construction shop drawings and six (6) copies of the supporting structural calculations report to the Owner for review and approval. This submittal shall include the following:
1. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.
  2. Qualifications Statement of Experience of the Retaining Wall Design Engineer as specified in paragraph 1.07, subparagraph B of this section.
  3. Certificate of Insurance of the Retaining Wall Design Engineer as specified in paragraph 1.06, subparagraph B of this section.

## 1.06 CONSTRUCTION SHOP DRAWING PREPARATION

- A. The Retaining Wall Design Engineer shall coordinate the retaining wall construction shop drawing preparation with the project Civil Engineer, project Geotechnical Engineer and Owner's Representatives. The General Contractor shall furnish the Retaining Wall Design Engineer the following project information required to prepare the construction shop drawings. This information shall include, but is not limited to, the following:
1. Current versions of the site, grading, drainage, utility, erosion control, landscape, and irrigation plans;
  2. electronic CAD file of the civil site plans listed in (1);
  3. report of geotechnical investigation and all addenda and supplemental reports;
  4. recommendations of the project Geotechnical Engineer regarding effective stress shear strength and total stress shear strength (when applicable) parameters for in-situ soils in the vicinity of the proposed retaining wall(s) and for any fill soil that may potentially be used as backfill in retained and/or foundation zones of the retaining wall.

- B. The Retaining Wall Design Engineer shall provide the Owner with a certificate of professional liability insurance verifying the minimum coverage limits of \$1 million per claim and \$1 million aggregate.
- C. Design of the precast modular block retaining wall shall satisfy the requirements of this section. Where local design or building code requirements exceed these specifications, the local requirements shall also be satisfied.
- D. The Retaining Wall Design Engineer shall note any exceptions to the requirements of this section by listing them at the bottom right corner of the first page of the construction shop drawings.
- E. Approval or rejection of the exceptions taken by the Retaining Wall Engineer will be made in writing as directed by the Owner.
- F. The precast modular block design, except as noted herein, shall be based upon:
  - 1. AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.03, subparagraph C.1., or
  - 2. NCMA, Design of Segmental Retaining Walls, referenced in Section 1.03.C.1
- G. In the event that a conflict is discovered between these specifications and a reasonable interpretation of the design specifications and methods referenced in paragraph F above, these specifications shall prevail. If a reasonable interpretation is not possible, the conflict shall be resolved per the requirements in paragraph 1.03, subparagraph A of this section.
- H. Soil Shear Parameters. The Retaining Wall Design Engineer shall prepare the construction shop drawings based upon soil shear strength parameters from the available project data and the recommendations of the project Geotechnical Engineer. If insufficient data exists to develop the retaining wall design, the Retaining Wall Design Engineer shall communicate the specific deficiency of the project information or data to the Owner in writing.
- I. Allowable bearing pressure requirements for each retaining wall shall be clearly shown on the construction drawings.
- J. Global Stability. Overall (global) stability shall be evaluated in accordance with the principals of limit equilibrium analysis as set forth approved standards as referenced in paragraph 1.03, subparagraph C.1. The minimum factors of safety shall be as follows:
 

Normal Service (Static)	1.4
Seismic	1.1
Rapid Drawdown (if applicable)	1.2
- K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.03, subparagraph C.1.

#### 1.07 QUALITY ASSURANCE

- A. Retaining Wall Installation Contractor Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the Retaining Wall Installation Contractor shall document compliance with the following:
1. Experience.
    - a. Construction experience with a minimum of 30,000 square feet (2,800 square meters) of the proposed precast modular block retaining wall system.
    - b. Construction of at least ten (10) precast modular block (large block) retaining wall structures within the past three (3) years.
    - c. Construction of at least 50,000 square feet (4,650 square meters) of precast modular block (large block) retaining walls within the past three (3) years.
  2. Retaining Wall Installation Contractor experience documentation for each qualifying project shall include:
    - a. Project name and location
    - b. Date (month and year) of construction completion
    - c. Contact information of Owner or General Contractor
    - d. Type (trade name) of precast modular block system built
    - e. Maximum height of the wall constructed
    - f. Face area of the wall constructed
  3. In lieu of the requirements set forth in items 1 and 2 above, the Retaining Wall Installation Contractor must be a certified Precast Modular Block Retaining Wall Installation Contractor as demonstrated by satisfactory completion of a certified precast modular block retaining wall installation training program administered by the precast modular block manufacturer.
- B. Retaining Wall Design Engineer Qualifications and Statement of Experience. The Retaining Wall Design Engineer shall submit a written statement affirming that he or she has the following minimum qualifications and experience.
1. The Retaining Wall Design Engineer shall be licensed to practice in the jurisdiction of the project location.
  2. The Retaining Wall Design Engineer shall be independently capable of performing all internal and external stability analyses, including those for seismic loading, compound stability, rapid draw-down and deep-seated, global modes of failure.
  3. The Retaining Wall Design Engineer shall affirm in writing that he or she has personally supervised the design of the retaining walls for the project, that the design considers all the requirements listed in paragraph 1.06 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.
  4. The Retaining Wall Design Engineer shall affirm in writing that he or she has personally designed in excess of 100,000 face square feet (9,000 face square meters) of modular block earth retaining walls within the previous three (3) years.
  5. In lieu of these specific requirements, the engineer may submit alternate documentation demonstrating competency in Precast Modular Block retaining wall design.
- C. The Owner reserves the right to reject the design services of any engineer or engineering firm who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.

#### 1.08 QUALITY CONTROL

- A. The Owner's Representative shall review all submittals for materials, design, Retaining Wall Design Engineer qualifications and the Retaining Wall Installation Contractor qualifications.

- B. The Owner's Representative shall retain the services of an Inspection Engineer who is experienced with the construction of precast modular block retaining wall structures to perform inspection and testing. The cost of inspection shall be the responsibility of the Owner. Inspection shall be continuous throughout the construction of the retaining walls.
- C. The Inspection Engineer shall perform the following duties:
1. Inspect the construction of the precast modular block structure for conformance with construction shop drawings and the requirements of this specification.
  2. Verify that soil or aggregate fill placed and compacted in the retained and foundation zones of the retaining wall conforms with paragraphs 2.04 and 2.05 of this section and exhibits the shear strength parameters specified by the Retaining Wall Design Engineer.
  3. Verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate.
  4. Inspect and document soil compaction in accordance with these specifications:
    - a. Required dry unit weight
    - b. Actual dry unit weight
    - c. Allowable moisture content
    - d. Actual moisture content
    - e. Pass/fail assessment
    - f. Test location – wall station number
    - g. Test elevation
    - h. Distance of test location behind the wall face
  5. Verify that all excavated slopes in the vicinity of the retaining wall are bench-cut as directed by the project Geotechnical Engineer.
  6. Notify the Retaining Wall Installation Contractor of any deficiencies in the retaining wall construction and provide the Retaining Wall Installation Contractor a reasonable opportunity to correct the deficiency.
  7. Notify the General Contractor, Owner and Retaining Wall Design Engineer of any construction deficiencies that have not been corrected timely.
  8. Document all inspection results.
  9. Test compacted density and moisture content of the retained backfill with the following frequency:
    - a. At least once every 1,000 square feet (90 square meters) (in plan) per 9-inch (230 mm) vertical lift, and
    - b. At least once per every 18 inches (460 mm) of vertical wall construction.
- D. The Owner's engagement of the Inspection Engineer does not relieve the Retaining Wall Installation Contractor of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.
- E. The Retaining Wall Installation Contractor shall inspect the on-site grades and excavations prior to construction and notify the Retaining Wall Design Engineer and General Contractor if on-site conditions differ from the elevations and grading conditions depicted in the retaining wall construction shop drawings.

#### 1.09 DELIVERY, STORAGE AND HANDLING

- A. The Retaining Wall Installation Contractor shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

- B. The Retaining Wall Installation Contractor shall store and handle all materials in accordance with the manufacturer's recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.
- C. Geosynthetics
  - 1. All geosynthetic materials shall be handled in accordance with ASTM D4873. The materials should be stored off the ground and protected from precipitation, sunlight, dirt and physical damage.
- D. Precast Modular Blocks
  - 1. Precast modular blocks shall be stored in an area with positive drainage away from the blocks. Be careful to protect the block from mud and excessive chipping and breakage. Precast modular blocks shall not be stacked more than three (3) units high in the storage area.
- E. Drainage Aggregate and Backfill Stockpiles
  - 1. Drainage aggregate or backfill material shall not be piled over unstable slopes or areas of the project site with buried utilities.
  - 2. Drainage aggregate material shall not be staged where it may become mixed with or contaminated by poor draining fine-grained soils such as clay or silt.

## PART 2 – MATERIALS

### 2.01 PRECAST MODULAR BLOCK RETAINING WALL UNITS

- A. All units shall be wet-cast precast modular retaining wall units conforming to ASTM C1776.
- B. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years, or the total time the manufacturer has been licensed, whichever is less.
- C. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the properties as shown in the following table:

## Concrete Mix Properties

Freeze Thaw Exposure Class <sup>(1)</sup>	Minimum 28-Day Compressive Strength <sup>(2)</sup>	Maximum Water Cement Ratio	Nominal Maximum Aggregate Size	Aggregate Class Designation <sup>(3)</sup>	Air Content <sup>(4)</sup>
Moderate	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3M	4.5% +/- 1.5%
Severe	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3S	6.0% +/- 1.5%
Very Severe	4,500 psi (30.0 MPa)	0.40	1 inch (25 mm)	4S	6.0% +/- 1.5%
Maximum Water-Soluble Chloride Ion (Cl <sup>-</sup> ) Content in Concrete, Percent by Weight of Cement <sup>(5,6)</sup>					0.15
Maximum Chloride as Cl <sup>-</sup> Concentration in Mixing Water, Parts Per Million					1000
Maximum Percentage of Total Cementitious Materials By Weight <sup>(7,9)</sup> (Very Severe Exposure Class Only):					
Fly Ash or Other Pozzolans Conforming to ASTM C618					25
Slag Conforming to ASTM C989					50
Silica Fume Conforming to ASTM C1240					10
Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume <sup>(8)</sup>					50
Total of Fly Ash or Other Pozzolans and Silica Fume <sup>(8)</sup>					35
Alkali-Aggregate Reactivity Mitigation per ACI 201					
Slump (Conventional Concrete) per ASTM C143 <sup>(10)</sup>			5 inches +/- 1½ inches (125 mm +/- 40 mm)		
Slump Flow (Self-Consolidating Concrete) per ASTM C1611			18 inches – 32 inches (450 mm – 800 mm)		

<sup>(1)</sup>Exposure class is as described in ACI 318. "Moderate" describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. "Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. "Very Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

<sup>(2)</sup>Test method ASTM C39.

<sup>(3)</sup>Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

<sup>(4)</sup>Test method ASTM C231.

<sup>(5)</sup>Test method ASTM C1218 at age between 28 and 42 days.

<sup>(6)</sup>Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

<sup>(7)</sup>The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.

(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.

(c) Silica fume, ASTM C1240, present in a blended cement.

<sup>(8)</sup>Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

<sup>(9)</sup>Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

<sup>(10)</sup>Slump may be increased by a high-range water-reducing admixture.



- D. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

Block Type	Dimension	Nominal Value	Tolerance
28" (710 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	28" (710 mm)	+/- 1/2" (13 mm)
41" (1030 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	40-1/2" (1030 mm)	+/- 1/2" (13 mm)
60" (1520 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	60" (1520 mm)	+/- 1/2" (13 mm)

\* Block tolerance measurements shall exclude variable face texture

- E. Individual block units shall have a nominal height of 18 inches (457 mm).
- F. With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 10 inches (254 mm), 7.5 inches (190 mm), or 6.75 inches (171 mm) in diameter and 4 inches (102 mm) or 2 inches (51 mm) in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 10 inch (254 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft (95 kN/m) at a minimum normal load of 500 lb/ft (7kN/m). as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft (160 kN/m). The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5 inch (190 mm) or 6.75 inch (171 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft (27 kN/m) at a minimum normal load of 500 lb/ft (7kN/m) as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft (146 kN/m). Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi (27.6 MPa) concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.
- G. The 28" (710 mm) and 41" (1030 mm) precast modular block units may be cast with a 13" (330 mm) wide, continuous vertical core slot completely through the block, or solid concrete.
- H. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft 6 in (4.42 m).
- I. The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the four (4) standard horizontal set-back facing batter options listed below:

<u>Horizontal Set-Back/Blk. Course</u>	<u>Max. Facing Batter</u>
3/8" (10 mm)	1.2°
1-5/8" (41 mm)	5.2°
9-3/8" (238 mm)	27.5°
16-5/8" (422 mm)	42.7°

The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the construction shop drawings.

- J. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 5.76 square feet (0.54 square meters) with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet (1.4 square meters) of wall face.
- K. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.
- L. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5" (38 mm) in its largest dimension and cracks not wider than 0.012" (0.3 mm) and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75" (19 mm) in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.
- M. Preapproved Manufacturers.  
Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 05481 US 31 South, Charlevoix, MI 49720 USA; telephone (866) 222-8400; website [www.redi-rock.com](http://www.redi-rock.com).
- N. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner's Representative reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.
- O. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

## 2.02 GEOTEXTILE

A. Nonwoven geotextile fabric shall be placed as indicated on the retaining wall construction shop drawings. Additionally, the nonwoven geotextile fabric shall be placed in the v-shaped joint between adjacent block units on the same course. The nonwoven geotextile fabric shall meet the requirements Class 3 construction survivability in accordance with AASHTO M 288.

B. Preapproved Nonwoven Geotextile Products

1. Mirafi 140N
2. Propex Geotex 451
3. Skaps GT-142
4. Thrace-Linq 140EX
5. Carthage Mills FX-40HS
6. Stratatex ST 142

## 2.03 DRAINAGE AGGREGATE AND WALL INFILL

A. Drainage aggregate (and wall infill for retaining walls designed as modular gravity structures) shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D422:

<u>U.S. Standard Sieve Size</u>	<u>% Passing</u>
1-½" (38 mm)	100
1" (25 mm)	95-100
½" (13 mm)	25-60
No. 4 (4.76 mm)	0-10
No. 8 (2.38 mm)	0-5

## 2.04 LEVELING PAD

- A. The precast modular block units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the Retaining Wall Design Engineer.
- B. Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in section 2.04 or a preapproved alternate material.
- C. Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

## 2.05 DRAINAGE

A. Drainage Pipe

1. Drainage collection pipe shall be a 4" (100 mm) diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi (152 kPa) per ASTM D2412.
2. The drainage pipe shall be manufactured in accordance with ASTM D1248 for HDPE pipe and fittings.

B. Preapproved Drainage Pipe Products

1. ADS 3000 Triple Wall pipe as manufactured by Advanced Drainage Systems.

2.06 WALL SURFACE FINISH – STAIN & SEALANT

- A. Contractor installing the wall system should ensure that any necessary holes for railings or fencing are drilled and all resulting slurry shall be removed by the installing contractor prior to the arrival of the Wall Color Professionals. The Wall Installation Contractor should remove mud and excessive surface soil by a water wash as needed and ensure that all final grading has been completed for the project.
- B. Final Surface Preparation of the wall will be provided by the Professional Color company upon arrival to perform the color project work as a final step for preparation. A sample panel will be created following surface preparation of the sample area, measuring approximately five by five feet and positioned in a location that is as accessible for reviewing as possible.
- C. Typical application for retaining walls will require a one coat, three color process designed to incorporate a base color and two accent colors. Ozark Bluffs Beige color range in EXMS 300 Series Custom Colorants is an example.
- D. A sheer, natural finish, professional grade, water-based, weather-tested professional staining system shall be used to create a natural stone color finish. The applicator shall be capable to customize the color as needed and the color system must be flexible to allow the color to be customizable on site during sample panel creation to suit the design team, with a sample being performed at the outset of the work.
- E. Custom colors may be provided to the Professional Color company to facilitate a color design which incorporates as few as three custom colors in to a blend, and many as six to seven colors in to a one blend, to match natural stone or other substrates. A standard color blend from the approved product line may be selected as referenced above, such as Ozark Bluffs Beige, however, minor changes and color adjustments may still be requested at the Sample Panel creation and may be provided by the Professional Staining Company.
- F. Anti-Graffiti products will be applied immediately following the proper set time as determined by the Professional Color Company's Project Manager. Anti-Graffiti products should be designed for compatibility with the color stain system and verify that the Anti-Graffiti product will not alter the color except to create slight deepening of the color and very slight increase to sheen, possibly. The expected finish will be "Natural Finish" for both the staining system and the Anti-Graffiti system. No high gloss products for the wall color or Anti-Graffiti will be used.
- G. The compatible Anti-Graffiti product should be verified not to void the Limited Color Warranty. Anti-Graffiti products should be applied by the trained color professionals as a final step to the completion of the wall color system specified to avoid any disruption to the color system during its cure time or any damage to the wall color.
- H. Measures must be taken by the Project's General Construction Manager on site to follow all protection from contact and final stipulations for the wall following the completion of the project, of note, especially during set and cure times noted by the Professional Color Company.

- I. Approved/Preferred Professional Grade Masonry & Concrete Staining Products designed for a natural stone look include:

EXMS 300 Series Custom Colorants

EXMS 400 Series DuraSealant & Anti-Graffiti Coat in Natural Finish

[Info@MasonryStaining.com](mailto:Info@MasonryStaining.com)

877-416-2824 ext.2

Direct Line 717-497-1282

Exact Match Masonry Staining, LLC

PO Box 720

Millerstown, PA 17062

- J. Limited Warranty:

1. A minimum fifteen-year limited warranty should be available for the color and run concurrently with the first five years that the anti-graffiti product will allow spray paint graffiti to be removed easily with one chemical and will bead or shed water for the duration of the five-year period.
2. Limited Warranty sample letters will only be considered if the stain products have been ASTM weather tested as indicated for a period exceeding the Limited Warranty letter.
3. A minimum five-year limited warranty that spray paint graffiti will be removed by one chemical and will bead or shed water for the duration of the five-year period shall be available as well.

- K. Authorized Applicators Only:

1. Project Management/on-site applicators must have proven experience engineering custom color on the field and are able to perform adjustment of color in real-time during sample panel creation to suit the owner and/or design team as needed. Project Manager shall be able to create and apply a matching stain blend in the specified, approved colors for the balance of the project, with all expected natural appearing variations, based on those approved sample colors.
2. Staining Professional Project Management team members should ensure that the colors used and approved on the sample panel will be used throughout the project and will not have dye lot issues from one end of the project to the other. Dye lots and color shifts will be detrimental to the final project. Random variations in the ratios and intensity of the approved colors will be used for mimicking natural stone, which is not to be construed as a dye lot issue.
3. Professional Staining Companies to be considered should have testing in place for field team members requiring high levels of color acuity, and have ten years minimum of successful, and demonstrate professional staining experience with creating color and application of sheer custom color on concrete and precast retaining walls, with the project experience representing accurate recreations of the look of natural stone with approved customizable water-based stain products.
4. Companies to be considered for working on Retaining Wall Staining should have a focus or specialization with creating natural stone color on retaining walls. Applicator experience for hardware store grade paint or coloring typical for concrete flatwork, stamped concrete, or floor finishing is very different and such experience is not to be considered to be transferred or

applicable to the necessary customization for Retaining Wall Color. The project requires a completely different skill set, products and product application experience for successful, Professional Retaining Wall Staining.

- L. Products applied should provide a natural finish with a low luster, and be specifically designed for retaining wall applications. Anti-Graffiti products should be guaranteed not to alter the stain color or cause a high gloss shine. Products used for Anti-Graffiti coatings should guarantee that they will not yellow over time or change the approved color of the stain beneath. A barely perceptible darkening and slight increase in sheen is acceptable, however a high gloss that will detract from a natural stone look is not acceptable.
- M. To ensure that no spalling or cracking will occur, the approved color products should have Freeze-Thaw testing in accordance with ASTM\_C67-09; Standard Test Method for sampling and Testing Brick and Structural Clay Tile. Before, during and after testing the specimens should be visually inspected for cracking. A crack is defined by ASTM C67 as a fissure or separation visible to a person with normal vision from a distance of one foot under an illumination of not less than 50 fc. No spalling or cracking should be noted at the completion of the testing cycles using the product to be applied to this project.
- N. Retaining Wall Color Testing Requirements:
  - 1. The approved color system should be tested to resist fade or change during typical weathering with a minimum weather testing performed in accordance with ASTM G154-06:Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials. The samples should be tested in the QUV for 1000 hours and cycled 16 hours in UV and 8 hours in condensation. Observations should be taken at 261 and 500 hours. No observations should be reported at 750 hours. The samples should be completed at 1006 hours with no discernible change occurring in the surface colorization between the control samples and completed samples at 1006 hours.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer's requirements.
- B. The General Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the retaining wall, shall be installed concurrent with retaining wall construction. The General Contractor shall coordinate the work of subcontractors affected by this requirement.
- C. New utilities installed below the retaining wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.
- D. The General Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.

E. All work shall be inspected by the Inspection Engineer as directed by the Owner.

### 3.02 EXAMINATION

A. Prior to construction, the General Contractor, Grading Contractor, Retaining Wall Installation Contractor and Inspection Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

### 3.03 PREPARATION

#### A. Fill Soil.

1. The Inspection Engineer shall verify that retained backfill material placed within a horizontal distance of one (1.0) times the wall height behind the wall blocks satisfies the criteria of this section.
2. The Inspection Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the Retaining Wall Design Engineer as shown on the construction drawings.

#### B. Excavation.

1. The Grading Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Grading Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Grading Contractor.
2. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the Retaining Wall Design Engineer and "Division 31, Section 31 20 00 – Earthmoving" of these project specifications.
3. Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.

#### C. Foundation Preparation.

1. Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted according project specifications. The Inspection Engineer shall document the volume of undercut and replacement.
2. Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.
  - a. The Inspection Engineer shall verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate. The Inspection Engineer shall

immediately stop work and notify the Owner if the in-situ shear strength is found to be inconsistent with the retaining wall design assumptions.

- b. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings per paragraph 1.06 I of this section.

D. Leveling Pad.

1. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.
2. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6" (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb (8.9 kN) of centrifugal force and to the satisfaction of the Inspection Engineer.
3. Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The Retaining Wall Installation Contractor shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

3.04 PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

- A. The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer's recommendations and these specifications, these specifications shall prevail.
- B. Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.
- C. Precast Modular Block Installation
  1. The first course of block units shall be placed with the front face edges tightly abutted together on adjacent blocks, on the prepared leveling pad at the locations and elevations shown on the construction drawings. The Retaining Wall Installation Contractor shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.
  2. Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks, and extend to a minimum distance of 12" (300 mm) behind the block unit.
  3. Drainage aggregate shall be placed in 9 inch maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 2,000 lb (8.9 kN) of centrifugal force.



4. Unit core fill shall be placed in the precast modular block unit vertical core slot. The core fill shall completely fill the slot to the level of the top of the block unit. The top of the block unit shall be broom-cleaned prior to placement of subsequent block courses. No additional courses of precast modular blocks may be stacked before the unit core fill is installed in the blocks on the course below.
  5. Base course blocks for gravity wall designs (without geosynthetic soil reinforcement) may be furnished without vertical core slots. If so, disregard item 4 above, for the base course blocks in this application.
  6. Nonwoven geotextile fabric shall be placed between the drainage aggregate and the retained soil (gravity wall design) if required on the retaining wall construction drawings.
  7. Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90 degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment. Drainage aggregate, unit core fill, geotextile and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.
  8. The elevation of retained soil fill shall not be less than 1 block course (18" (457 mm)) below the elevation of the retained backfill throughout the construction of the retaining wall.
  9. If included as part of the precast modular block wall design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer's recommendation.
- D. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:
1. Deviation from the design batter and horizontal alignment, when measured along a 10' (3 m) straight wall section, shall not exceed 3/4" (19 mm).
  2. Deviation from the overall design batter shall not exceed 1/2" (13 mm) per 10' (3 m) of wall height.
  3. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2" (13 mm).
  4. The base of the precast modular block wall excavation shall be within 2" (50 mm) of the staked elevations, unless otherwise approved by the Inspection Engineer.
  5. Differential vertical settlement of the face shall not exceed 1' (300 mm) along any 200' (61 m) of wall length.
  6. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2" (13 mm).
  7. The wall face shall be placed within 2" (50 mm) of the horizontal location staked.

### 3.05 WALL INFILL AND BACKFILL PLACEMENT

- A. Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:

1. 98% of maximum dry density at  $\pm 2\%$  optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.
- B. Compactive effort within 3' (0.9 m) of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 3' (0.9 m) of the back of the precast modular blocks.
- C. Backfill material shall be installed in lifts that do not exceed a compacted thickness of 9" (230 mm).
- D. At the end of each work day, the Retaining Wall Installation Contractor shall grade the surface of the last lift of the granular wall infill to a  $3\% \pm 1\%$  slope away from the precast modular block wall face and compact it.
- E. The General Contractor shall direct the Grading Contractor to protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

### 3.06 OBSTRUCTIONS IN THE INFILL ZONE

- A. The Retaining Wall Installation Contractor shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.
- B. Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the Retaining Wall Design Engineer can appropriately address the required procedures for construction of the wall section in question.

### 3.07 COMPLETION

- A. For walls supporting unpaved areas, a minimum of 12" (300 mm) of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.
- B. For retaining walls with crest slopes of 5H:1V or steeper, silt fence shall be installed along the wall crest immediately following construction. The silt fence shall be located 3' to 4' (0.9 m to 1.2 m) behind the uppermost precast modular block unit. The crest slope above the wall shall be immediately seeded to establish vegetation. The General Contractor shall ensure that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.
- C. The General Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The General Contractor shall notify the Owner of any deviations.

END OF SECTION 323215

## SECTION 323300 – SIGNS

### 1.1 DESCRIPTION:

- A. This work shall consist of fabricating, furnishing, assembling and erecting signs and delineators.
- B. Materials and construction operations not specifically covered in the drawings and specifications shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, US Department of Transportation, Federal Highway Administration.

### 1.2 MATERIALS

- A. Materials shall conform to the latest edition of the DOT Standard Specifications including but not limited to Signs, Delineators, Fiberglass, and Portland cement concrete for sign post footings.

### 1.3 CONSTRUCTION

- A. Regulatory and Warning Signs: Regulatory and warning signs shall be fabricated of flat aluminum sheets and shall be covered with Type II reflective sheeting. Legends, borders, and accessories shall be Type B. Signs shall be fabricated in accordance with the following:
  - 1. Positioning Signs: The placement of signs shall be adjusted if they create interference in a sidewalk area. Sites at which the signs are to be erected shall be inspected immediately after grading of the area and prior to determining the sign post lengths.
  - 2. Mounting Signs: Signs shall be mounted on bendaway sign supports. Upon being notified that the signs have been installed, the Engineer will examine at either the upper or lower bolts, whichever best minimizes the glare. In all cases, shims shall be installed between the back of the sign and the post. Shims shall be used wherever necessary to prevent sagging of the center of a sign and to permit secure tightening of all nuts and bolts.
- B. Guide Signs: Guide signs fabricated of flat aluminum sheets shall be covered with Type I reflective sheeting.

Breakaway couplings will be furnished upon written request. The request shall be made at least ten (10) days prior to the time when needed for the project and shall include the quantity of each type required.

Guide signs shall be fabricated in accordance with the following:

- 1. Positioning Signs: Sign faces shall be so positioned in relation to a line normal to the adjacent edge of traveled way that the sign face is rotated about its edge, nearest the traveled way, through an angle of 5°, in the direction of travel. All signs shall be level and at the heights indicated.

2. Mounting Signs: Signs shall be mounted on bendaway sign supports. Upon being notified that the signs have been installed, the Engineer will examine them at night. Should specular reflection from any sign be apparent, alignment shall be adjusted.
- C. Cleaning Signs: Before final inspection, all sign faces and support surfaces shall be signs, sign supports, and sign sites are in good condition and have a good appearance.

END OF SECTION 323300

## SECTION 329200 – TURF AND GRASSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sodding.
- B. Related Sections:
  - 1. "Earthwork" for excavation, filling and backfilling, and rough grading.
  - 2. "Exterior Plants".

#### 1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass sod, identifying source, including name and telephone number of supplier.
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

- E. Material Test Reports: For existing surface soil and imported topsoil.
- F. Planting Schedule: Indicating anticipated planting dates for each type of planting.
- G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required initial maintenance periods.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
  - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
  - 1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

#### 1.7 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion. No lawn fertilization is permitted between December 1 and April 1.
  - 1. Spring Planting: April 1 - June 1.
  - 2. Fall Planting: September 15-October 15.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

## 1.8 MAINTENANCE SERVICE

- A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
  - a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
- 2. Sodded Lawns: [30] days from date of planting completion.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

## PART 2 - PRODUCTS

### 2.1 TURFGRASS SOD

- A. Turfgrass Sod: Certified, including limitations on thatch, weeds, diseases, nematodes, and insects], complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows
  - 1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
  - 2. Sun and Partial Shade: Proportioned by weight as follows:
    - a. 50 percent Kentucky bluegrass (*Poa pratensis*).
    - b. 30 percent chewings red fescue (*Festuca rubra* variety).
    - c. 10 percent perennial ryegrass (*Lolium perenne*).
    - d. 10 percent redtop (*Agrostis alba*).

### 2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones **1 inch** or larger in any dimension and other extraneous materials harmful to plant growth.
  - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least **4 inches** deep; do not obtain from bogs or marshes.

2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
3. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
  - a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

## 2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
  2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
  3. Provide lime in form of dolomitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through [1-inch] [3/4-inch] [1/2-inch] sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  1. Organic Matter Content: [50 to 60] percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.



- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
  - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of [0.15 lb/cu. ft.] of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of [0.25 lb/cu. ft.] of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

## 2.5 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

## 2.6 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- E. Refer to soil test recommendations for fertilizer composition.
- F. Fertilizer composition and application to comply with New York State and local laws.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  - 2. Protect grade stakes set by others until directed to remove them.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of [6 inches]. Remove stones larger than [1 inch] in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Apply superphosphate fertilizer directly to subgrade before loosening.
  - 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  - 3. Spread planting soil mix to a depth of [4 inches] but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Spread approximately 1/2 the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top [2 inches] of subgrade. Spread remainder of planting soil mix.
    - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
  - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
  - 2. Loosen surface soil to a depth of at least [6 inches]. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top [4 inches] of soil. Till soil to a homogeneous mixture of fine texture.

- a. Apply superphosphate fertilizer directly to surface soil before loosening.
- 3. Remove stones larger than **1 inch** in any dimension and sticks, roots, trash, and other extraneous matter.
- 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus **1/2 inch** of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

### 3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  - 1. Lay sod across angle of slopes exceeding 1:3.
  - 2. Anchor sod on slopes exceeding 1:6 with wood pegs[ or steel staples] spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of **1-1/2 inches** below sod.

### 3.5 LAWN MAINTENANCE

- A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
  - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- B. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of **4 inches**.
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water lawn with fine spray at a minimum rate of **1 inch** per week unless rainfall precipitation is adequate.
- C. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
  1. Mow grass to a height of **1 to 2 inches**.
- D. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.
  1. Use fertilizer that will provide actual nitrogen of at least [**1 lb/1000 sq. ft.**] to lawn area.

### 3.6 SATISFACTORY LAWNS

- A. Lawn installations shall meet the following criteria as determined by Architect:
  1. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

### 3.7 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.
- C. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 329200

## SECTION 329300 – PLANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Trees.
  - 2. Shrubs.
  - 3. Ground cover.
  - 4. Plants.
- B. Related Sections include the following:
  - 1. "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

#### 1.3 DEFINITIONS

- A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.
- B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
- C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- D. Finish Grade: Elevation of finished surface of planting soil.
- E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each of the following:
  - 1. Pavers for paved tree pits.
- C. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
  - 1. Manufacturer's certified analysis for standard products.
  - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- D. Qualification Data: For Landscape Installer.
- E. Material Test Reports: For existing surface soil and imported topsoil.
- F. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
  - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
  - 1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.
- D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
  - 1. Selection of exterior plants will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.
- E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements **6 inches** above ground for trees up to **4-inch** caliper size, and **12 inches** above

ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

- F. Observation: Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

- 1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver exterior plants freshly dug.
- B. Do not prune trees and shrubs before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- C. Handle planting stock by root ball.
- D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.
  - 1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
  - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  - 3. Do not remove container-grown stock from containers before time of planting.
  - 4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

## 1.7 COORDINATION

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Planting: March 15- June 15
  - 2. Fall Planting: September 15- October 15
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

## 1.8 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
  1. Warranty Period for Trees and Shrubs: One year from date of Substantial Completion.
  2. Warranty Period for Ground Cover and Plants: One year from date of Substantial Completion.
  3. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
  4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
  5. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

## 1.9 MAINTENANCE

- A. Trees and Shrubs: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.
  1. Maintenance Period: Three months from date of Substantial Completion.
- B. Ground Cover and Plants: Maintain for the following maintenance period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings:
  1. Maintenance Period: Three months from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.



- D. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- E. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

## 2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
  - 1. Provide balled and burlapped trees.

## 2.3 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

## 2.4 CONIFEROUS EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
- B. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens and the following grade:
  - 1. Heavy Grade:
  - 2. Provide balled and burlapped trees.

## 2.5 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1 and the following requirements:

## 2.6 PLANTS

- A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

## 2.7 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones **1 inch** or larger in any dimension and other extraneous materials harmful to plant growth.
  - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

- a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
3. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
  - a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

## 2.8 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
  1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
  2. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
  3. Provide lime in form of dolomitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.9 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least **0.15 lb** of ammonium nitrate or **0.25 lb** of ammonium sulfate per **cubic foot** of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

## 2.10 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: **1 lb/1000 sq. ft.** of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
  2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

## 2.11 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood

## 2.12 STAKES AND GUYS

- A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, **2 by 2 inches** by length indicated, pointed at one end.
- B. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, **0.106 inch** in diameter.
- C. Guy Cable: 5-strand, **3/16-inch** diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of **3 inches** long, with two **3/8-inch** galvanized eyebolts.
- D. Hose Chafing Guard: Reinforced rubber or plastic hose at least **1/2 inch** in diameter, black, cut to lengths required to protect tree trunks from damage.
- E. Flags: Standard surveyor's plastic flagging tape, white, **6 inches** long.

## 2.13 MISCELLANEOUS PRODUCTS

- A. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Trunk-Wrap Tape: Two layers of crinkled paper cemented together with bituminous material, **4-inch** wide minimum, with stretch factor of 33 percent.

## 2.14 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers as per recommendations from Rutgers soil testing laboratory based on soil testing.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.

- D. Lay out exterior plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  - 1. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

### 3.3 TREE AND SHRUB EXCAVATION

- A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
  - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
  - 2. Excavate at least **12 inches** wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.
- B. Subsoil removed from excavations may not be used as backfill.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
  - 1. Hardpan Layer: Drill **6-inch** diameter holes into free-draining strata or to a depth of **10 feet**, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### 3.4 TREE AND SHRUB PLANTING

- A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
  - 1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- B. Set stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
  - 1. Carefully remove root ball from container without damaging root ball or plant.

2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- C. Wrap trees of 2-inch caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping.

### 3.5 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.
- B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

### 3.6 GUYING AND STAKING

- A. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Use the number of stakes as follows:
  1. Use 2 stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; 3 stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
- B. Guying and Staking: Guy and stake trees exceeding 14 feet in height and more than 3 inches in caliper, unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade.
  1. For trees more than 6 inches in caliper, anchor guys to pressure-preservative-treated deadmen 8 inches in diameter and 48 inches long buried at least 36 inches below grade. Provide turnbuckles for each guy wire and tighten securely.
  2. Attach flags to each guy wire, 30 inches above finish grade.
  3. Paint turnbuckles with luminescent white paint.

### 3.7 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants as indicated.
- B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.8 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated.
  - 1. Organic Mulch: Apply **3-inch** average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

### 3.9 CLEANUP AND PROTECTION

- A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

### 3.10 DISPOSAL

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 329300





## SECTION 330500 – COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Transition fittings.
  - 3. Sleeves.
  - 4. Grout.
  - 5. Flowable fill.
  - 6. Piped utility demolition.
  - 7. Piping system common requirements.
  - 8. Equipment installation common requirements.

#### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. PVC: Polyvinyl chloride plastic.

#### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.6 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

### 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. AWWA Transition Couplings NPS 2 and Larger:
  - 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Fittings:
  - 1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Description: MSS SP-107, PVC four-part union. Include brass threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping:

1. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

## 2.3 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

## 2.4 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

## 2.5 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, Portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

## PART 3 - EXECUTION

### 3.1 PIPED UTILITY DEMOLITION

- A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- J. Verify final equipment locations for roughing-in.
- K. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 3. PVC Non-pressure Piping: Join according to ASTM D 2855.

### 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.5 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.6 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

## SECTION 333100 – SANITARY SEWER

### PART 1 - GENERAL

#### 1.1 SANITARY SEWER PIPE

##### A. DESCRIPTION

Sanitary sewer pipe shall consist of trench excavation, removal of existing sanitary sewer, bypass pumping as required, furnishing and installing new sanitary sewer as specified, bedding material, backfill and complete restoration of disturbed areas, construction layout of new sanitary sewer with service laterals and follow up internal television inspection.

##### B. MATERIALS

###### 1. Pipes and Fittings

- a. Polyvinyl chloride pipe (PVC) and fittings shall conform to the specifications set forth in ASTM D 3034, heavy wall class SDR 35.

##### C. CONNECTIONS

1. Pipe connections to the manhole shall be made with flexible connectors capable of sealing the annular space between the pipe and the manhole opening and of centering the pipe in the opening.
2. Connections to existing pipe, if and where applicable, shall be the fernco flexible pipe coupling appropriate for the material for the existing pipe, fernco couplings, or approved equal.

##### D. CONSTRUCTION REQUIREMENTS

###### 1. Sanitary Sewer Replacement

- a. Open cut excavations shall be made in accordance with the latest provisions of "Subpart P - Excavations, Trenching and Shoring" taken from the Department of Labor, Occupational Safety and Health Administration Construction Safety and Health Regulations as published in the Federal Register and also in accordance with the requirements of the DOT Standard Specifications, to protect life, property or the work.
- b. The existing sanitary sewer pipe shall be removed as indicated on the plans. Upon removal of the existing pipe, bypass pumping shall be provided except at the direction of the engineer. The contractor shall provide and maintain pumps, piping, hoses, labor, and supervision necessary for the bypass pumping during sanitary sewer replacements.
- c. Excavation shall be carried to a depth of six inches below the existing invert grades. Upon this subgrade foundation, a cushion of bedding material as per the construction detail shall be placed and compacted to the grade of the underside of the pipe barrel. The pipe shall then be set to the line and grade and additional bedding material placed to one foot above the pipe.

- d. Pipe shall not be laid until the exact locations of utility structures in the vicinity have been determined in the field and the line and grade of the pipes have been approved by the engineer.
- e. Supports for existing utilities shall be provided as directed by the engineer.
- f. Dewatering methods and equipment shall be adequate to properly dewater the work and shall be subject to the approval of the engineer. In no case will the laying of pipe or the placing of masonry be permitted with water in the excavation nor will completed portions of the work be used as a means of dewatering trenches. Water removed from the work shall be disposed of in an approved manner without damage to adjacent property or other work. All sewage wastes removed from the excavation shall be transported to the municipal sewage treatment plant for disposal.
- g. Pipe shall be installed according to the manufacturer's recommendations and the current best practice in the industry.
- h. When cutting the pipe is required, the work shall be done with a power saw using a blade appropriate for the material in order to leave a smooth end at a right angle to the axis of the pipe.
- i. Prior to the laying of pipe and trench drains, the method to control alignment and grade shall be submitted for approval. The method shall be a laser system or grade board set up to establish a reference grade and alignment control directly above or in the pipe and along the invert of the trench drain.
- j. Broken pipe or otherwise damaged pipe shall be replaced.
- k. Existing sanitary sewer service laterals must be confirmed by the contractor either during construction or through records obtained by the municipality. All sanitary sewer house connections shall be made flush with the outside edge of the new sanitary sewer pipe and shall be watertight.
- l. The contractor should exercise care during construction. If any damage occurs to the existing sanitary pipes, manholes, or service laterals because of the contractor's operations, all damaged material shall be replaced in kind and in a manner satisfactory to the municipality at the contractor's expense.
- m. All excavations shall be completely backfilled and as great a portion as possible of the excavated material shall be used for backfill. The excavated material to be used for backfill shall be free from stumps, brush, weeds, roots, sod, rubbish, garbage, and other matter that may decay. The excavated material to be used for backfill shall also be free from rock, boulders, frozen materials and clay. It shall be suitable granular material as approved by the engineer. Excavations and backfill shall meet the requirements of Section 2.1 - Earthwork and other applicable sections of this specification.

## 1.2 MANHOLES, SANITARY SEWERS

### A. DESCRIPTION

- 1. The work of this item shall consist of the construction of sanitary sewer manholes in accordance with the drawings and specifications, at the required locations and to the prescribed lines, grade, and dimensions.



## B. MATERIALS

1. Material shall conform to the requirements specified therefore in the DOT Standard Specifications.

## C. CONSTRUCTION REQUIREMENTS

1. The manhole bottoms shall be Class C concrete. Concrete channels shall be formed in the bottom with a cross section of the depth of one half the sewer diameter, shall slope to the outlet, matching the exact shape of the sewer invert. Channels shall have a minimum slope and shall have a smooth surface.
2. Manhole walls shall be constructed of concrete block and all joints between blocks shall be completely filled with 1:2 cement-sand mortar. Joints shall be made to produce a smooth and uniform surface. The outside surface of each manhole shall be plastered 1/2 inch thick, and troweled smooth with cement-sand mortar of the same consistency as above. The outside plastered surface shall be allowed to dry, and then shall be painted with one seal coat of coal tar or asphalt. Manhole walls may be constructed of poured concrete, subject to approval by engineer.
3. Frames shall be well bedded in mortar, making a watertight joint, and shall be adjusted so that the rim is approximately 1/4 inch above finished grade. Cover and frame shall have a shop coat of asphaltic pitch and shall have a field coat of similar paint after the frame is set in final position. Steps shall be provided in the manhole as shown on the drawings.
4. Each manhole shall be constructed absolutely watertight. Manholes that are not watertight will not be accepted. Plastering on top of defective joints to correct leaky conditions will not be permitted.
5. All work shall be done in a workmanlike manner and shall be subject to inspection, requirements and approval of the Municipality.
6. Precast manholes shall be an acceptable alternative.

## 1.3 SANITARY SERVICE CONNECTIONS

### A. DESCRIPTION

1. The work of this item shall consist of the replacement and construction sanitary sewer laterals from the proposed sanitary sewer pipe to behind the proposed or existing curb, risers, and branch connections. The new lateral shall be of equal or greater size than existing.
2. This item shall include the excavation, removal of existing, bypass pumping as required, furnishings and installing the new sanitary service lateral between the main and a new cleanout, bedding material, backfill and complete restoration of disturbed areas, and a construction layout showing the new service laterals and sanitary sewer main. Also to be included will be a new pipe cleanout, tee, hub, and all miscellaneous items and labor necessary for installation from the main to the new cleanout and to connect the new service lateral from the building to the new cleanout.

### B. MATERIALS

1. Polyvinyl chloride (PVC) sewer pipe and fittings shall be of 4", 6" or 8" size and shall be manufactured in accordance with ASTM specification D-3034 (SDR-35).

2. Fittings shall be made from virgin PVC compound having a cell classification of 12454-B, 12454-C, or 13343-C, as defined in ASTM D-1784. Different cell classifications having one or more superior properties may be acceptable and shall be submitted to the engineer for approval.
3. Fittings shall be suitable for use with SDR-26 gravity sewer pipe and shall not deflect more than the pipe when loaded and bedded in the same manner.
4. Joints shall be push on type and shall be in accordance with ASTM D-3212. Joints shall be as manufactured by Johns-Manville "ring-tite", certain-teed "fluid-tite" or approved equal.
5. Rubber-ring gaskets shall be molded or extruded and suitable for use with sewage, resistant to oil or solvents, and "in conformance with ASTM D-1869". The compound consisting of either a synthetic or natural rubber basis polymer and shall meet the following physical specifications:

Durometer Hardness, Points	52-62 Min.
Ultimate Tensile PST	2000 Min.
Elongation-Percent	350 Max.
Tension Set At 250°F	10% Max.
Modulus At 300%	1200-2300 Psi

#### C. CONSTRUCTION REQUIREMENTS

1. The contractor shall also aid the engineer taking measurements as necessary to permanently locate branch conditions.
2. Building laterals shall be laid coincidental with, or shortly after, the main sewer is installed so that repairs and cleanup are rapidly completed.
3. The pipe shall be laid on continuous upgrade of not less than 1/4" per foot and located where ordered by the engineer.
4. The General Contractor (GC) shall be responsible for the service connection from the main to the building and the connection to the building sanitary waste line.

#### 1.4 GENERAL

- A. The Contractor shall be responsible for all conditions, requirements, and inspections as stated in applicable permits and in accordance with the latest edition of the DOT Standard Specifications.

END OF SECTION 333100

## SECTION 333900 – SANITARY SEWER STRUCTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Expansion joints.
  - 2. Encasement for piping.
  - 3. Manholes.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For expansion joints.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 MANHOLES

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 2. Diameter: 48 inches or 72 inches minimum – see drawings.
  - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  - 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
  - 5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
  - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
  - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  - 9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 15-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover (or sizes as indicated on the site plans or construction detail sheets.) Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

## 2.2 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes. Benches to be swept in 72" diameter manhole.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
  - a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
  - a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section "Earthwork."

### 3.2 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- E. Install manhole-cover inserts in frame and immediately below cover.

### 3.3 IDENTIFICATION

- A. Materials and their installation are specified in Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
  - 1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  - 1. Submit separate report for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
  7. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- E. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- F. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- 3.5 CLEANING
- A. Clean interior of piping. Remove dirt and debris as work progresses.
  - B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
  - C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 333900

## SECTION 334100 – STORM DRAINAGE

### PART 1 - GENERAL

#### 1.1 GENERAL

Furnish and install the storm drainage system as shown on the drawings.

The Contractor shall furnish and install manholes, outlet structures, trench drains, slot drains, catch basins, stormwater chambers, storm pipe, and fittings shown on the drawings.

Existing pipe and storm water structures to remain in place shall be cleaned and all debris removed shall be disposed of off site. The piping to remain in place shall be saw cut and prepared for connection with the new drainage structures and piping.

#### 1.2 STORM PIPE

- A. Scope: The Contractor shall furnish, lay and joint storm drainage pipe as shown on the drawings.

The work shall include all labor, tools, materials, and equipment including bedding and joint materials.

- B. Type of Pipe:

1. N-12 Pipe double wall HDPE as manufactured by ADS or equivalent
  - a. HDPE pipe shall have a smooth interior and annular exterior corrugations and in accordance with ASTM F2648.
2. Schedule 40 PVC.
  - a. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - b. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
  - c. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
  - d. Adhesive Primer: ASTM F 656.
    1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - e. Solvent Cement: ASTM D 2564.
    1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Pipe Requirements:

1. The pipe shall be accurate and of uniform dimensions. All pipe shall be straight and true to form without bulges, dents, cracks, tears, or defects which will affect strength and shall have no bulges or dents on interior surfaces which will result in a noticeable variation in diameter from that obtained on adjacent unaffected portions of the surface.
2. Only domestic materials shall be offered, provided as follows, notwithstanding any inconsistent provision of law and unless the owner shall determine it to be in consistent with public interest or the cost to be unreasonable. Only pipe manufactured in the United States shall be used on this project.
3. The contractor shall supply pipe in standard lengths.
4. Each length of pipe shall be furnished with the manufacturer's designation indicating class, size, and batch of pipe.
5. The Contractor shall supply standard manufactured fittings and adapters for all bends and differences in pipe diameters.

D. Pipe Installation:

1. All pipe shall be carefully examined for dents, cracks, and other defects, and no pipe known to be defective shall be laid. If any pipe is found to be broken or defective after being laid, it shall be removed and replaced with a sound pipe without any further payment.
2. Joint surfaces shall be protected from damage and shall be carefully examined before jointing. No damaged joints shall be used in the work.
3. Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after laying. Exposed ends of the sewer shall be provided with temporary plugs or covers.
4. All pipe shall be carefully laid to true alignment and grade. The trench bottom (6" below invert of pipe) shall be carefully graded to the proper elevation and the maximum practical solid bearing area shall be provided throughout its entire length, prior to swinging the pipe into place.
5. Care shall be taken not to excavate below grade (6" below invert). Material excavated below grade shall be replaced by material that meets with the approval of the Engineer.
6. All trenches shall be dewatered prior to laying pipe.
7. Pipe to be installed at indicated slopes free of sags and bends.
8. Install fittings for changes in direction, branch connections and changes in pipe diameter.



9. Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbance.
10. Pipe shall be protected during construction against possible floatation in case the trench becomes flooded prior to placing the backfill.
11. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
12. Install sleeves for piping penetrations of walls.

E. Jointing:

1. PVC pipe jointing:
  - a. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - b. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - c. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.
2. HDPE pipe
  - a. Pipe shall be joined using a bell & spigot joint meeting ASTM F2648.
  - b. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
3. Pipe shall be carefully jointed in conformity with the best practice and the detailed instructions of the manufacturer.
4. All pipe ends shall be thoroughly cleaned prior to and during the jointing operation.
5. At the manholes and inlet connections use flexible water stops, resilient connectors, or other flexible connections to the structures.

### 1.3 CLEANOUTS

A. Plastic Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC storm sewer pipe fitting and riser to cleanout of same material as storm sewer piping.

### 1.4 CATCH BASINS

A. Standard Precast Concrete Catch Basins (inlets and trench drains):

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  2. Base Section: 8-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
  3. Riser Sections: 6-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
  4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  6. Retain one of first two subparagraphs below if required.
  7. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  8. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
  9. Steps: ASTM A 615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
  10. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted bicycle safe drainage openings.
1. Size: 24 by 24 inches minimum unless otherwise indicated.
  2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

#### 1.5 CATCH BASIN INSTALLATION

- A. General: Install catch basins, complete with appurtenances and accessories indicated.
- B. Install precast concrete catch basin sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of catch basins that occur in pavements.

#### 1.6 UNDERGROUND STORMWATER CHAMBERS

- A. Underground stormwater chambers are designed for stormwater management through retention and infiltration of controlled stormwater runoff. Chambers are to be Cultec Recharger V8HD units or approved equal.
- B. The chambers will be arched in shape and open-bottomed. Chambers will be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings or separate end walls.
- C. The nominal chamber dimensions shall be 32 inches tall, 60 inches wide and 8 feet long. The installed length of a chamber shall be 7.5 feet. The nominal chamber dimension of a "starter" or "end" unit shall be 32 inches tall, 60 inches wide and 5.08 feet long, with an installed length of 4.58 feet.
- D. The "intermediate" chamber units will have two side portals to accept feed connectors to create an internal manifold. The nominal dimensions of each side portal will be 10.5 inches high by 12 inches wide. The nominal chamber dimensions of the feed connectors shall be 12 inches tall, 16 inches wide and 24.2 inches long.
- E. The chambers will have discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
- F. The chambers will have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.

#### 1.7 SLOT SURFACE DRAIN

- A. Slot surface drain as manufactured by Duraslot or approved equal.
- B. Drain shall be manufactured from corrugated polyethylene pipe with a smooth inner wall, with pipe and fittings conforming to AASHTO M252.
- C. A grate frame that forms a slot shall be mounted in the pipe so as to provide a linear inlet into the top of the pipe to collect surface runoff. The slot shall be manufactured from .063 tempered commercial aluminum and shall have two parallel plates separated by vertical spacers spanning the slot on 6" centers.
- D. The grating within the slot opening shall be ½ - #13 galvanized steel. The slot shall be coated with a primer to protect the aluminum when installed in concrete.
- E. The flange at the bottom of the slot shall be riveted to the pipe with a minimum of two rivets per linear foot. The pipe shall have a section removed to accept the slot so as to maintain the original diameter.
- F. Cover the slot opening during construction to prevent clogging with poured concrete or asphalt. The top of the slot opening should always be set 1/8" to ¼" below finished grade. Follow manufacturer's instructions for installation.

#### 1.8 MANHOLES AND STORM OUTLET STRUCTURES

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Diameter: As indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 8-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36".
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: iron unless otherwise indicated.

## 1.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.

- e. Exfiltration: Water leakage from or around piping.
- 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
- 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

#### 1.10 IDENTIFICATION

- A. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  - 1. Use detectable warning tape over ferrous piping.
  - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 334100